

Tow Center for Digital
Journalism

THE RESPONSIVE CITIES INITIATIVE

WHAT A UNIVERSITY COULD DO TO HELP

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I. Executive Summary

Over the last few months, the Responsive Cities Initiative convened three workshops supported by a planning grant from the Ford Foundation and hosted by the Tow Center for Digital Journalism at Columbia Journalism School. The workshops gathered leading thinkers with the aim of answering the following question: What could a university center do to advance policymaking and planning for fiber-optic networks that provide everyone in the United States with high-speed Internet access and (a) improve local governance and (b) support civic journalism? We invited leading U.S. fiber builders, city officials, and civic journalists to the first two sessions and hosted a large group of Danish utility fiber companies and lawmakers at the third. This paper presents our findings.

We held these meetings at an opportune time. Fiber connectivity to the Internet is now becoming the global standard. Demand for “gig cities” (or those equipped with fiber-optic Internet connections to homes and businesses that can transfer at least a billion bits of data per second) is growing in America and elsewhere. As a nation, however, our percentage of fiber connections as part of our overall high-speed Internet access is low, as compared to some other developed nations. Now is the time to invest in America’s communications infrastructure. Interest rates are at historic lows, many Americans would welcome the construction jobs created by a large-scale upgrade to fiber, and the ambitious plans that many cities have to use data to be responsive to their citizens’ needs depend on fiber being in place. Finally, a fiber upgrade could further promote the role of media in public life. Just as the advent of television and radio were occasions for reflection on how a healthy media

ecosystem is sustained, so too might we begin thinking now about how best to support the role of journalism in an age of unlimited communications capacity.

At the same time, many voices—for many reasons—oppose plans to build or ensure the availability of fiber connectivity. States and cities feel cash-strapped, oppressed by soaring pensions, employee health care costs, and deferred maintenance costs that far exceed revenue growth. Income and wealth inequality is growing, making access “for everyone” sound quaint and impossible. As one RCI attendee said about libraries and postal services, “If you were to introduce these ideas now in 2014 and there had never been a library or postal service before, you’d be called totally crazy. We’re just going to socialize the collection of stuff and people can just pick it up for free?” Even some civic technologists (those interested in using data to govern more effectively and collaboratively) are not convinced that fiber is essential.

Meanwhile, incumbent cable providers and wireless companies are more than happy with the status quo and have historically carried out prolonged and difficult fights over city-initiated fiber projects. For data connections over 25 megabits per second (Mbps), more than three-quarters of Americans have just one choice—their local cable monopoly. Cable companies’ control of key sports and other programming further raises the barriers to entry for new fiber competitors. Data about the effects of fiber installations on particular communities, economic and otherwise, is scarce.

Given these constraints and barriers, the long-term planning required for universal fiber access is difficult to accomplish. Perhaps a university could help.

RCI brought in two sets of stakeholders that had not previously been focused on how fiber connectivity could support their initiatives: the “civic data” movement (both inside and outside city halls in the United States) and journalists. Increasingly customer-centric cities will be grappling with huge amounts of data stemming from sensors, outside databases, and data coming from inside existing city functions that, when understood, could be used to improve the effectiveness of government and empower public employees to act

with discretion and professionalism. (Professor Crawford’s recent book, *The Responsive City*, with co-author Stephen Goldsmith, focuses on the intersections between data and governance.)

Right now, though, many cities can’t use this vast trove of data because they can’t put it through their pipes. Even though cities today imagine using data scientists, algorithms, and visualizations galore, the necessary transport infrastructure for this work is often nonexistent. As one former public employee put it during one of the workshops, “The reality is there’s very big data out there, right? And we need to start harnessing that. We’ve solved the idea of platforms and Hadoop and MongoDB and all that, but we don’t have the way to transport it.”

Similarly, few data journalists have engaged with the policy questions involved in getting fiber into cities, nor may they have considered how an upgrade to fiber could be an opportunity for supporting local journalistic functions.

These meetings were a revelation for many attendees. Few had considered the crosscurrents among these disciplines. Many could imagine fruitful engagements and research projects that a university could facilitate. The confluence of civic tech, journalism, and infrastructure studies can happen only at an academic center that pulls together public policy, law, design, urban planning, and other disciplines—and can harness the energy of undergraduates who want to change the world.

It can be difficult to appreciate radical change when you are in the middle of it, but many RCI participants agreed that we have arrived at a tipping point for life in cities. As computation becomes much faster and storage becomes vanishingly cheap, the addition of unlimited communications capacity could prompt a phase change in urban life.

We emerged with four broad areas in need of further investigation:

1. **Trust and privacy:** Cities must focus on citizens’ concerns about privacy and security. Without trust between city governments and citizens in place, many of the exciting developments becoming possible with unlimited communications capacity and

data will be threatened. A university could be helpful in pulling together research, convening conferences, and otherwise making progress on these thorny issues—with collaboration from public employees and journalists.

2. **Fiber network best practices and needed policies:** Although ad hoc case studies on city fiber networks are emerging, rigorous, hard-nosed explorations of different business models and replicable toolkits for making fiber decisions are scarce. A university could be a source of case studies and comparative data, as well as suggestions for future policy changes. For example, it could help to:
 - (a) Demonstrate the private and public investment case for fiber using detailed case studies.
 - (b) Forecast outcomes of planned or proposed policy changes. For example, constraints on the availability of programming (e.g., sports) continue to raise barriers to entry for competing fiber networks. How would unbundling affect the content marketplace?
 - (c) Serve as a repository for helpful documentation, including pole and conduit policy best practices, ordinances cutting back on the power of landlords to interfere with residential/business choices of fiber providers, and municipal fiber funding models.
 - (d) Help cities (e.g., members of Next Century Cities) communicate more effectively with ordinary citizens about fiber.
 - (e) Promote giga-tourism by assisting public officials, libraries, and journalism schools in existing gig cities to attract conferences, conventions, hackathons, and other meetings to their cities. These initiatives would enhance public and government awareness of the “Internet dividend” and build support for new revenue sources for local journalism.
 - (f) Demonstrate a successful collaboration between municipal fiber and local journalism as a powerful signal. Cities with gigabit networks could work with community journalists to

develop projects that show how fiber can support a rich local news environment. Such evidence would ensure that journalism is part of the conversation about the benefits of fiber across the United States.

- (g) Demonstrate similarly successful collaborations between local government and civic technologists that depend on the the presence of fiber connections.

3. **Research on spillovers:** Research about the economic, cultural, and social benefits of fiber networks is thin. Although fiber enthusiasts may believe that the social benefits and other spillovers of fiber far exceed their social costs, not everyone is on board. A university research function could be useful in connecting students and professors to data and prompting publication of studies examining these hard questions, particularly in these sample areas:

- (a) *Healthcare.* A research project investigating not only how high-capacity fiber could be used but also the possible savings associated with it might convince the healthcare insurance industry of the economic efficiency of supporting high-speed connectivity; insurance companies might become a major source of funding. In this example, the healthcare industry could act as a catalyst, prompting other industries to see what is possible with fiber.
- (b) *Civic technology.* A research center could investigate the intersections among traditional city infrastructure (water, sewage, power) and fiber-connected sensor networks, closely examining expenditures, cost savings, and policy shifts associated with the move to fiber.
- (c) *Journalism.* A research center is the ideal locale for facilitating pilots between journalists and local government by identifying areas of mutual interest. Journalists could effectively translate government data (including streamed video) to inform and involve citizens. On a more intimate scale, this could facilitate storefront, local accountability journalism

based on information from hearings and other public meetings.

- (d) *Infrastructure.* A research center has the resources to identify and convene a stable of young economists who are interested in building their careers in infrastructure economics.

4. **Pipeline:** It is crucial to build a network of students who want to serve in local government and understand the importance of high-capacity networks in policymaking and urban life. A university center could:

- (a) Create supervised work opportunities focused on data-driven innovation and planning inside city hall for students, both undergraduate and graduate.
- (b) Convene conferences about privacy, case studies, and spillovers that students and staff run, making students responsible for follow-up and publications; and support Media Lab-like experimentation in connection with the hard, fiber-related problems civic tech and journalism face.

II. Introduction

Across the United States, many mayors are calling for the creation of fiber-optic networks to serve municipal buildings and other city locations where people live, work, and play. America's basic two-way communications lines haven't been upgraded since the introduction of the cable modem more than fifteen years ago. Mayors are listening to citizens and businesses clamoring for world-class, inexpensive, symmetric, and ubiquitous Internet access over fiber. Indeed, the availability of inexpensive fiber-optic access in cities is rapidly becoming as important a social issue as electrification was decades ago; like electricity, cheap and unlimited Internet access will be necessary as an essential input into every aspect of future economic, cultural, and social life.

President Obama has recognized the importance of giving mayors the choice to call for the building of fiber networks in their cities. Earlier this month, he visited Cedar Falls, Iowa, and applauded that town of 40,000 inhabitants for having the foresight to build a community network and then upgrade it to fiber. He noted that there are laws in 19 states that make it difficult or impossible for other cities to do the same, and pledged that his administration would do "anything it can" to remove those laws. As he put it, "In some states, it is virtually impossible to create a community network like the one that you've got here in Cedar Falls. So today, I'm saying we're going to change that. Enough is enough. We're going to change that so every community can do the smart things you guys are doing."

At the same time, cities are facing constituents in need of greater responsiveness. They're accustomed to using Facebook, Twitter,

and Google and are impatient with the slow pace and archaic nature of traditional city services. Rising to the challenge, public employees inside city hall are discovering new ways to provide services, empower public employees, and collaborate with citizens by harnessing and understanding the flood of data generated by urban life. Meanwhile, journalists are grappling with how to use data and connectivity to provide context and immediacy to their stories while continuing to pay their bills.

These three developments relate to one another. Without fiber connectivity, cities won't have a sustainable foundation for the data-driven changes that are otherwise possible in governance. The nation's move to fiber should be accompanied by policies that support the role of journalism in democracy, and journalists should be equipped to understand and take advantage of unlimited communications capacity. Mayors considering the pros and cons of fiber access need to be able to answer the question, "What do you need gigabit access for?"

Most people involved in its reply—fiber enthusiasts, civic technologists, and new flavors of journalists alike—limit their vision to what is currently possible, making it difficult to imagine the full benefits of a fiber-enabled future. These groups are not in touch with one another and haven't yet discovered the intersections that could empower them all. The Responsive Cities Initiative is aimed at advancing this process of discovery.

Fiber-optic access is a technology that is at once both new and old. Although it was introduced decades ago in other countries, it is new enough to our country that people in the United States may not understand how it works. Fiber-optic networks are made up of hundreds of thin, flexible strands of pure glass. Each strand is less than a tenth as thick as a human hair and can carry ten million different phone calls—or any other form of information—around the world at the speed of light. Pulses of light from lasers carry the information making up those voices, online sessions, or videos. The particles of light, or photons, stay within each thin glass strand (within the "core" of the fiber) as they zip along. Every strand is surrounded by cladding made up of a different form of glass

containing properties that encourage the light to stay within the pure, transparent core—so it doesn't leak out. Since light travels more slowly inside that cladding signals inside the core tend to stay there.

Compared to radio waves, light carries tens of thousands of times more information because it is vibrating at such high frequencies. (More wobbles per second, more opportunities to add data to each wobble.) Scientists discovered in the 1960s that if a glass fiber core was extraordinarily pure and transparent it could carry a million times more information in the form of light than radio waves were able to just fifty years before. Photonics (the science of encoding data on light pulses) is advancing at such an extraordinary rate that engineers have not found a limit to the amount of information each glass thread can carry. As science marches on, the electronics that trigger lasers to shoot out encoded light can be swapped out as improved versions are developed. The pure glass strands, meanwhile, stay in place for decades once installed. In other words, these networks are “future proof.” The ducts in which they're laid will last for fifty years and the fiber itself for thirty.

What's new about fiber-optic access to the Internet is its potentially unlimited capacity to carry information, both in the form of data received and sent. What's old about universal fiber access is that it is like clean water, electricity, a street grid, or a decent basic education: It is (or will be, once installed) a basic substrate for everything we do, allowing everyone to thrive, increase their choices and possibilities in life, and communicate when needed without worrying about availability or cost. Given that civilization advances by extending the number of operations we can perform without thinking of them, these “old technology” aspects of fiber are highly desirable. Once fiber is everywhere, we will no longer have to wait for spinning circles on our screens to go away, worry about whether the job we're doing—or someone in the other room is doing—will cause us to overrun our allotment of bits, or redial a call (or relaunch a video meeting) because the connection has dropped (or the image has frozen).

Imagine what would be possible in an American city fully served

by fiber-optic Internet access to every home, business, and public building. Simple tasks like navigation would become easy, as inadequate wireless capacity would cease to choke citizens' mobile access to the Internet. The nuts and bolts of transport and energy systems could be adjusted on the fly in response to predetermined triggers: "We need the lights to turn green to speed this late city bus on its way" or "We need to manage energy use in this particular municipal conference room because it is not being occupied" would become routine statements. Collaborating across offices in areas like film editing, modeling the predicted progress of a disease using 3D genomic maps, or performing a string quartet when each member is in a different location would be an option. Self-driving cars, safer and shareable, could become the norm, navigating deftly using wireless signals supported by rich networks of fiber. (If this sounds ridiculous, that's probably good; a useful statement about the future often initially seems this way.)

Assisted living centers outfitted with sensors could enable home health aides to focus on one-on-one interactions with residents rather than mechanical room visits every few minutes. New media industries would emerge quickly if unlimited upload capacity became routine, and the energy of community-oriented startups (whose employees tend to ride buses and bicycles and give back to their communities) could infuse itself into every city.

Humans don't care about buzzwords like "throughput" or "gigabytes." But they do care about seeing others and being seen, about existing simultaneously. With screens fed by fiber connections, neighborhood concerns and city hall initiatives could become visible to anyone interested. Education, journalism, and health-care, all fields that could benefit enormously from collaboration across physical boundaries, would change with the possibilities of fiber. With these high-capacity connections, the pixels fall away. You are there—in the classroom, in the doctor's office, in the courtroom—having an immediate, personal involvement with the event rather than watching passively. Hospitals and clinics could carry out virtual medicine, performing surgeries remotely.

Here's the point: Stripped to its essence, fiber will allow anyone

to be present with another where both parties agree. What they'll get is full-bandwidth communication, a complete sense that they are in the same room. Think of fiber as a glass window that can provide the sight and sound of any environment in as real a way as we can experience. (Smell, taste, and feel are informational as well and will someday be synthesized elements of online experiences.) The same fiber capacity that allows for human presence can also be used to manipulate, understand, visualize, and transport vast amounts of data.

Moving to ubiquitous, cheap fiber is a phase change, a minimum jump that will produce maximum change in many human lives, in the governance of cities, and in the function of journalism. The empires of the future are the empires of the mind, and there is nothing a mind wants more (or reaps the most benefit from) than communicating with others. If talking about "minds" seems too abstract, insert "entrepreneur," "innovator," or "job-creator"—or just take a look at China. That country is already planning to connect two hundred to three hundred million of its citizens to fiber in an effort to support middle class productivity and national economic growth.

Until now, the builders of fiber in America have been fully occupied with the job of persuasion. They aren't well connected to either civic tech or journalistic circles. And neither civic technologists nor journalists have been engaged with fiber-optic technology, either as a policy matter or subject of their demands. But all three of these groups need one another. The right question for American cities and for the country is really not, "What's a gig for?" Better questions are, "Where do we want humans to go? What do we want them to be?"

Without the involvement of local leadership, driven by a public mission to make cities more responsive to their citizens (which includes taking on hard problems in privacy and security), or journalists intent on explaining what's going on in the world of data, we will continue to stumble forward with a series of short-term decisions. We need a long-term vision for our collective high-capacity future, and public-minded individuals need to be involved.

III. The Workshops

In the fall of 2014, a diverse group of government officials, industry leaders, academics, advocates, and data scientists from the United States and abroad met at the Tow Center in New York City to discuss the future of fiber and civic technology in America. Conversations centered on intersections among participants from the worlds of fiber infrastructure, government, data, and journalism, focusing on key questions about the future of these institutions in a fiber-enabled society:

1. What are the possibilities for connecting fiber advocacy with data science/civic technology?
2. How can governments use data and fiber to become more responsive?
3. How will fiber support new possibilities in journalism?
4. What can we learn from each other across sectors, cities, and nations in the effort to promote fiber development?

Across three meetings, these representatives—diverse stakeholders in the fiber future—generated intense and dynamic conversations across disciplines and geographies. Participants identified common needs and aspirations and suggested new collaborations.

Visions for a Fiber Future

If cities had fiber networks that served everyone—rich and poor, apartment-dwellers and businesses—how could government be more

responsive? What kinds of sensor-driven applications in transportation, environmental quality, infrastructure maintenance, and health care could help government serve citizens? How might the data drawn from those applications support the work of journalists in their efforts to ensure government accountability and promote civic participation? In short, what would the fibered city of the future look like? Workshop participants imagined a fiber future that is user-centric, collaborative, and adequately protective of privacy.

Data for People: As fiber expands, it will allow government, industry, and journalists to collect more data. While this data can be used to improve services, it can also be shared directly with citizens. How can cities make data legible to citizens? How can data allow citizens to answer their questions? How can journalists help citizens identify the story in the data? In addition to finding effective data visualization techniques, governments and journalists must think about how and where they communicate with citizens—the more touch points, the better.

Lots of Screens: More points of interaction between government and citizens facilitate more open and accessible city services. New York City is planning a citywide network of kiosks providing Wi-Fi and direct links to services through responsive portals. Cities must think about how they will interface with citizens and where these interactions take place.

Privacy is Critical: Data can reveal sensitive information about citizens. In order to maintain and expand this trust, cities and other data collectors need to articulate their commitment to thoughtful data usage rules—and consequences for data abuse by employees. There is room for local governments to take a lead role in voicing the importance of privacy and data security. One workshop attendee, a public employee, said:

When you think about transparency and performance management and customer service—all the things that data can allow—I think that builds up to create trust with citizens. And I think government's been under attack for forty years by a certain segment to get rid of that trust and to break this link that citizens have with their government. And that's impacting us very directly. So, right now, we would love to do more along these lines.

Cross-sector Collaboration: In the fully connected city, collaboration could flourish across public, private, nonprofit, and institutional sectors with robust citizen participation. In this scenario, cities must recognize undervalued assets, including libraries and post offices, which are tasked with supporting the delivery of information to all citizens. Truly effective collaboration will include methods for data sharing across sectors and economic partnerships that benefit all parties.

Enforcing Government Accountability: Journalism has a critical role in government accountability. Simple transparency isn't enough. Governments can publish their data, but unless journalists are available to search, analyze, and interpret it—and find the hidden stories within—transparency is not likely to lead to accountability.

Data Literacy and Open Government: With training in data literacy, journalists will be able to leverage open government tools and find stories in the data that others lack the time and training to identify. Data-savvy journalists will also help cities improve their open-government policies through communication and feedback, ultimately advancing both government's open-data programs as well as journalists' ability to leverage them.

Putting the Citizen and Reader at the Center: New technologies allow audiences to access more news, but they also allow journalists to know more about their audiences. By collecting data about user preferences, journalists are developing innovative platforms tailored to the news users care about, as well as when and where they want to access it. Putting the reader at the center shifts the model of journalism from broadcast to personalization and facilitates an interactive news environment, in which users connect directly with each other to share information. Why is it, then, that journalists follow technology rather than involving themselves in its development?

Moving toward high-capacity, ubiquitous connectivity is becoming more important every day. While the ability to collect and analyze data is expanding, local governments will find that their communications infrastructure is insufficient for the task of manag-

ing, sharing, combining, and visualizing the inundation of information becoming available. As the Internet provides audiences with more information, journalists are defining how they add value. New technologies are prompting both established institutions like *The New York Times* as well as new media outlets like Medium.com to launch new platforms. Technology is inspiring new forms of journalistic inquiry, with data leading the way.

These developments rely on the transmission of text, images, and video at high speeds, both up and down. Fiber connectivity will be required for U.S. cities to remain globally relevant and continuously innovative. Indeed, although we are capable of imagining a wide array of ways in which fiber would advance city services, public participation, civic journalism, and economic development today, there must be a digital-age equivalent of a young Mozart out there who is only waiting for fiber installation to create something we never imagined.

IV. Existing Infrastructure: Where We Are Now

The Path to Fiber

Although a fully fibered American future may sound attractive, we have a long way to go. Right now, cable incumbents provide most high-capacity connections in this country, operating without real competition or oversight. The companies selling these connections set their prices at will and have no particular incentive to upgrade their hybrid fiber coaxial connections (built to greatly privilege downloads over uploads) to fiber-optic, symmetrical, ubiquitous, reasonably priced lines into houses and businesses.

In particular, most high-speed U.S. residential connections are by way of cable modems. DSL, the copper wire product sold by the telcos, is essentially becoming the new dial-up—because it does not have the communications-carrying capacity of cable. Cable and telcos engage in so-called “bounded competition.” They do not engage in destructive price wars. DSL technology is outdated at this point, but hangs on to its 2540 percent share in many markets as companies offer low speeds at a discount relative to cable products. It is in the cable companies’ interest to allow DSL to exist as a “competitor,” so as to fend off regulation. Cable companies, accordingly, have largely avoided offering low-speed, low-priced branded products. This status quo is mutually beneficial to the cable companies (which never enter one another’s territories) and legacy phone providers.

Cable modem technology accounts for 73.4 percent of connections with speeds of at least 10 Mbps downstream and 1.5 Mbps upstream. While asymmetric digital subscriber line (ADSL) technology accounts for 31.1 percent of connections of more than 200 Kbps in either direction, it only accounts for 11.6 percent of connections with speeds of at least 10 Mbps downstream and 1.5 Mbps upstream. (Translation: There is very little fast DSL in the United States.) The FCC has suggested that 25 Mbps is a good potential threshold for high-speed Internet access, but 90 percent of 25 Mbps subscriptions go to cable. DSL just can't compete for these higher speeds. Where local cable monopolies face competition only from copper, they get 98.99 percent of subscriptions for 25 Mbps. The presence of a fiber competitor radically transforms this landscape. Where fiber-to-the-home (FTTH) exists, cable gets just 56 percent of subscriptions for 25 Mbps. But there is very little FTTH in our country: FTTH makes up just 9.5 percent of overall U.S. subscriptions.

In the United States, there is a growing consensus among policymakers, business leaders, civic activists, and others that advanced fiber-based communications networks are crucial tools for economic growth, public accountability, and civic engagement. Despite considerable economic, regulatory, and political obstacles, many cities and municipalities around the country are racing to upgrade their networks using fiber technology.

Today the United States has about eleven million FTTH connections, according to Jim Baller of the Baller Herbst Law Group, with an estimated one hundred and thirty-five FTTH networks serving some four hundred communities. By contrast, China will have an estimated two hundred million to three hundred million fiber connections within the next few years. This represents a competitive issue for our country.

Where cities have been able to develop adequate fiber infrastructure, however, benefits materialize. For example, Santa Monica built a fiber network hoping to drive economic development, but quickly realized it served many other purposes. Today, the network is used to manage transport networks, support public safety, and

provide free Wi-Fi in commercial corridors.

Fiber buildout across the country has been limited by the failure to set adequately high standards for basic communications networks or use the levers of government to subsidize fiber installations (or make copper too expensive to maintain). In other words, our low level of fiber is a result of policy.

Incumbent carriers have tremendous political support from elected officials, who have in turn benefited from large campaign contributions. Both Republican and Democratic officials have historically received substantial contributions from these incumbent companies, but GOP lawmakers in Congress have been their most vocal supporters.

Google's initial fiber project in Kansas City, first announced in March of 2011, has been usefully disruptive; it brought media attention to the issue and publicly demonstrated the feasibility of fiber in the home. Government funding for fiber through the Recovery Act provided further evidence in support of the value of fiber investments. Moreover, public satisfaction with high-speed Internet-access costs and level of service continues to erode as people begin to realize how essential this is to their lives. This transition will help to bolster efforts to expand fiber in cities around the United States.

The overall Internet connectivity picture for many urban residents in the country is grim, even for speeds far slower than those fiber offers. Indeed, the digital divide in U.S. cities remains extraordinary. Fully 40 percent of houses in Detroit have no Internet access at all, whether over a mobile device or a wire. And an astonishing 56 percent of houses in Detroit don't have what the FCC calls "fixed broadband subscriptions" (meaning anything other than dial-up or access over mobile devices). More than a third of Cleveland residents have no Internet access at all. Miami; New York City; Los Angeles; Boston; Washington, D.C.; and Chicago are all on the list of underserved communities.

As urban and rural communities alike experience the drawbacks of insufficient bandwidth, local communities have mobilized to address the issue themselves by building municipal fiber networks.

But here too there are obstacles: As the President has noted, approximately nineteen states have established legal prohibitions on municipal fiber provision. Industry lobbyists and ideologically driven national groups like the American Legislative Exchange Council pushed these laws at the state level with the aim of protecting entrenched incumbent providers by frustrating the efforts of municipalities to develop their own advanced communications networks.

The FCC is currently weighing a petition from two municipalities, Chattanooga, Tennessee, and Wilson, North Carolina, asking the federal government to preempt restrictive state laws and allow them to expand their advanced networks. President Obama supports the idea that the FCC should preempt these restrictive laws. As he puts it: “I’m on the side of competition. And I’m on the side of small business owners. I’m on the side of students and schools. I believe that a community has the right to make its own choice and to provide its own broadband if it wants to.” These petitions could set an important national precedent in favor of municipal fiber, and have consequently been vigorously opposed by the incumbents, their lobbyists, and their allies in Congress.

Interest and demand is growing. Until now, no incumbent was proposing to build a gigabit network anywhere in New England. But Connecticut recently put out a request for quotation (RFQ) for dark open access gigabit fiber at a reasonable wholesale cost and forty-six cities quickly responded—collectively, those cities represent about half the state’s population, and they’re all looking to build gigabit networks. Available access to ultra high-speed Internet access is becoming critical to urban infrastructure, similar to electricity, water, and roadways.

The State of Civic Technology

In the United States, the civic technology movement is thriving. Civic technology harnesses the power of the increasing availability of data to connect people, improve cities, and make government more effective. Today, data is available from multiple sources, including social media, sensors, mobile applications, and nearly every

digital activity. Civic technologists cultivate these large collections of data, especially those about human behavior, and analyze them computationally to reveal patterns. For example, data on public transportation usage can reveal valuable insights about ridership trends, which can then help city officials make decisions about improving relevant services.

Across the country, the current generation of American twenty-somethings is impatient with the slow pace and outmoded functioning of government and is skeptical that government has any real role to play in their lives. Nevertheless, as visionary leaders in cities and municipalities take the lead in developing the next generation of civic technology, many younger people are looking for an opportunity to serve.

For example, last fall more than nine hundred people, including representatives from at least one hundred twenty cities, attended the Code for America summit in San Francisco. The chief topics—data-driven governance, predictive analytics, and better use of technology by government—were all grounded on the assumption that citizens and government will be using handheld devices to communicate. (Fiber is necessary for carrying all that handheld data to the Internet; wireless and wired communications are deeply complementary.) Millennials really are different. They can't breathe without very high-capacity access.

In Santa Monica, fiber is working to serve citizens in new ways. While fiber access was originally regarded as an economic engagement tool, it has evolved into far more. Today, buses run on time as traffic signals are automated to hold a green light for them. Real-time parking trackers cut down on emissions and save time. Police officers wear audio and video on their lapels to transmit data over a shared network. Santa Monica is an incubator for what is possible with fiber, and it continues to innovate.

Chicago has seen a rich and varied ecosystem of people and organizations play different roles in pushing civic tech forward. Mayor Rahm Emanuel brought a strong team to city hall; the MacArthur Foundation has provided extensive funding; a wide range of civic tech developers is actively engaged with the city; and

nonprofit Smart Chicago plays a crucial role as an intermediary between the city and its communities.

Pittsburgh has taken advantage of strong relationships with Carnegie Mellon and the University of Pittsburgh to move forward with data analytics. Pittsburgh, which will be a 2015 Code for America host city, has a vibrant open data community made up of coders, data geeks, community organizers, designers, government officials, and academics (called, collectively, Open PGH).

Lexington, Kentucky, part of a sprawling metropolitan area of about five hundred thousand inhabitants, has ambitious plans for data, including using GPS data on sanitation trucks to help cut down on the 75 percent of 311 calls made about garbage and recycling collection. The city is interested in using data to improve its operations and will need to invest in infrastructure for its data systems to do so.

New York City is investing in an ambitious project called LinkNYC that will replace pay phones with twenty-first-century communications kiosks. By upgrading ten thousand existing payphones to provide free unlimited high-speed WiFi, the city hopes to advance equality and ease of access. The devices, called Links, will be outfitted with tablets that allow for many functions—from calling a taxi, to applying for a job, to learning about city services. There will be large displays on the sides of the Links for public service announcements (like, “You’re in an evacuation zone”). New York City hopes to continually raise the bar so that in five years these ideas seem quaint.

Stockholm is years ahead of the United States, making millions of dollars a year by leasing out its dark (unlit) wholesale fiber network to retail providers. There, 100 Mbps symmetric connectivity is ten to fifteen dollars a month; gigabit is thirty dollars a month. The city estimates that it has reaped three times the cost of its investment in this network in direct and indirect benefits—from lower prices, to greater choices in civic services, to money the government itself has saved.

The fiber revolution in Internet connectivity will create opportunities for a host of new city applications, including responsive

transportation systems and citizen service applications in areas like emergency services, crime prevention, healthcare, and voting. Most of these applications will rely on the fact that many city residents now carry a smartphone—“mobile super-computers”—that transmits personal data.

Cities must be transparent about the data they collect from and push to these devices. Lack of public trust will undermine even the most well-meaning effort to use fiber infrastructure to better serve citizens. This risk cannot be overstated and must be proactively addressed.

In order to build support for investments in infrastructure and data, U.S. cities must learn to tell the story of how these technologies benefit citizens. It can be hard for people to weigh the value of high-speed Internet access against critical services like policing and education, but this is not a zero-sum game: Investments in foundational infrastructure pay dividends in public safety and schools, in addition to supporting economic development and government efficiency.

The State of Journalism

The Internet has rumbled through the news business, lowering barriers to entry for products Americans view as substitutable and permitting other actors to siphon off advertising revenue on which newspapers had depended. The weaknesses of local news are by now well known. Citizens are often relegated to watching a “repetitive stream of accounts of national-level political maneuvering, crisis-oriented coverage of national and international events, or videotape of fires, crimes, and disasters,” according to a recent report from Murrow Rural Information Initiative. At the same time, the local news business has significant strengths that can be a foundation for building in the digital age. Using their existing expertise, local journalists are able to reach far larger audiences than ever before.

As the Internet provides audiences with more information, journalists are redefining how they add value to public discourse. But just as technology has provided journalists with new tools, it has

also challenged the business model that allowed national and local news outlets to thrive during the twentieth century.

Local newspapers and news stations traditionally relied on classified and other local forms of advertising for revenue. But the Internet, particularly websites like Craigslist, has severely undermined those once-reliable revenue sources. As the Internet upended the traditional news business economic model, local news organizations were among the top casualties.

Another consequence of the Internet's impact was the transformation of journalism from a discrete model based on individual stories to a continuous one with ongoing updates and a steady stream of new information. To become more "continuous," newspapers have added more endpoints—from computers to phones and tablets—to reach people where they are. The end goal is to produce a continuous ecosystem that delivers a steady flow of information to users, where and when they need it. One media employee and RCI attendee explained:

We are reaching people wherever they happen to be in lots of different situations and conditions. We've had to have a real shift, and it's one that we're continuing to go through to change the way that our workflow works so we can send out information as soon as we have it, we can continue to refine it, we can correct it, we can draw it if we need to. And we are having an ongoing conversation with the reader as opposed to delivering end results.

Meanwhile, regular citizens are now increasingly producers, as well as consumers, of information. If news organizations know that citizens are close to an unfolding event, they reach out and encourage them to capture news and share it with an Internet audience via video, photo, or writing. This requires a key curatorial role for news outlets that tracks and manages citizen content and delivers quality news to their audiences.

News outlets are also striving to enhance the experiential dimensions of journalism. As another RCI media attendee said, "A lot of the news business will be the experience business. You'll be able to bring anyone into a live experience of a news event at any point. Or make them aware of context. How do you generate attentional

proximity? How do you bring people close to events in a way that is meaningful for them?”

The increasingly tenuous state of the local news business model raises serious questions about local government accountability. Without trained journalists, the news will be extractive and citizens will see only public information. The big question remains: How can technology help local journalism establish a more sustainable business model? It may be that subsidies for local journalism tied to fiber upgrades and subscriptions are the only practical answer.

Cities across the country are racing to improve fiber access and affordability. But conversations about the value of fiber center around economic development, health care, and education, while the issue of journalism remains peripheral. It's important to make journalism top-of-mind for cities that are building this infrastructure. A successful demonstration of economic and substantive collaboration between municipal fiber and local journalism could be a powerful signal. Cities with gigabit networks should work with community journalists to develop projects that show how fiber can support a rich local news environment.

V. Barriers

The fiber-enabled and data-driven future promises many benefits to many people. Why aren't these resources already in place? Across locations and industries, there are several common challenges. These challenges touch all sectors and highlight the critical importance of collaboration in advancing fiber in the United States.

Who funds fiber?

Building fiber is expensive, but (as with any basic infrastructure project) costs can be recouped over time if a project is well planned. In the United States, the key obstacle has been finding parties that are able and willing to provide the long-term funding needed to develop robust fiber networks.

In order to attract the funding required to build ubiquitous fiber, advocates must be able to demonstrate the benefits—both economic and social—that will result from fiber deployment. Although there are several cases, such as those in Santa Monica and Chattanooga, that demonstrate the benefits of fiber, their gains must be more formally documented. For example, Chattanooga has learned a great deal about electricity use and its response to emergencies because of its fiber network, and the utility is changing the city's internal behavior by monitoring this information. Fiber and data aren't just for creating new opportunities; they can also improve processes through performance management.

Economic and business case evidence is thin on the ground. Many other case studies need to be carried out. We do know, though, that fiber is now cheaper to deploy than anything else,

and that no one ever says his or her fiber Internet access connection is too fast. But the economics of overbuilding cable, even without legal restrictions, are tough—and require more extensive analysis than currently exists.

Necessary Policy Changes

Regulation plays a central role in governing infrastructure development and content distribution. In our country, the federal government has made limited progress in using its authority to force competition. Meanwhile, limited budgets and fierce incumbent opposition often hamper municipalities that want to move toward change. The role of local governments is further complicated by the fact that incumbents pay large franchise fees to the cities in which they operate, which go into that government's budget, thus disincentivizing major regulatory transformations. Regulation at state and local levels can pose significant challenges to progress in fiber deployment; twenty states have existing barriers to local choice for building fiber networks, and more such barriers will be introduced during the coming year. Pole attachment policies, program access policies, procurement hurdles, and related barriers need to be lowered. Little broadly collaborative work is taking place along these lines.

Lack of Long-term Planning

To plan and finance complex technology projects, governments and private sector stakeholders have to take the long view, planning carefully and investing with an eye toward future benefits. Such long-term planning can be difficult to execute when pressing political and economic demands are vying for attention and political commitment. In order to prioritize long-term economic and political investments in fiber—putting the important ahead of the urgent—cities will need support from a wide range of stakeholders and evidence that fiber provides widespread benefits. Without such evidence and political will, it will be hard for local governments to justify the investment of time and finances fiber requires.

One public employee RCI attendee said:

How do you articulate the business case with us and share that with the right decision-makers and stakeholders within both the city government and the state government, and make sure that those decision-makers have the information they need and the data behind it to really act in the best interest of the community?

Functional and Sectoral Silos

Governments and their partners are often siloed, with functions cordoned off and communications difficult. In the absence of skilled leadership, no one in government has an incentive to take risks. The development of next-generation infrastructure will require the coordination of many functions and sectors, which means strong leadership is essential.

As one RCI attendee from an electrical utility put it, “Cities are a bit like electric companies. They’re slow-moving. And the problem is that no single work group has a need that will benefit enough from fiber to justify the expense. Only when you look at it from a total perspective can you justify it.” Data can help make this case, but only leadership can require that everyone get in line and cooperate. Leaders, in turn, can learn from other leaders.

Privacy Concerns

Citizen concern over data privacy can throw up roadblocks to ambitious technology projects. Although we’re confident that digital technology can be used to better personalize services, predict needs before they arise, and improve engagement (both in journalism and for governance), the drive toward personalization must be balanced with the goal of keeping people’s private information secure. Any promise of security is becoming an increasingly challenging commitment as the urge to share and the benefits of doing so grow. One former public sector employee suggested that all sensor data collected go directly into open data portals, which may either forestall or amplify concerns about security. Any major blowup along these lines holds the potential for substantially derailing progress.

Lack of Technology Expertise

People who understand technology can better make the case for investing in data-driven governance and fiber. Educating the existing workforce within government and bringing in new experts will help cities communicate the importance of technology as a key component of all policies—not just a ministerial add-on. While the lack of expertise is particularly acute in the public sector, every sector needs employees who are both technically aware and sensitive to key policy concerns. We need to fill the pipeline.

A public sector RCI attendee outlined the arc of this crucial issue well:

I think it's really critical that we're focused on the types of employees we have in city government and the leadership that we're attracting to city government; that they're also capable of using the technology and the data that exists today and comfortable with trusting the data. And then when it comes to the process side, I think a responsive city in the future will employ sort of a trifecta mindset, and they'll understand and be looking for the ways that they can work with the private sector, or the nonprofit sector, or the educational space to accomplish the things that they need to overcome the community challenges that we have. A responsive city, you know, will be able to identify, track, analyze, and use that data and put that data into the hands of people who need that information and need to use it to make decisions, whether it's the folks in city government or the community at large. And then on the technology side, I think—and this is really something that I'm passionate about, especially for our own technology departments within city government—putting them at the forefront of the conversation and not having them be a back office support function anymore.

Filling the pipeline will require changing the curriculum of policy programs in graduate schools and integrating applied, hands-on work into traditional studies.

Collaborating with the Private Sector on Financing

Governments can require that private fiber projects meet public obligations, while also ensuring that they are profitable. The emer-

gence of private sector patient capital, with a longer timeline for producing a return on investment, could provide an opportunity for governments to work with private investors to develop much-needed infrastructure. As one attendee said, “There’s a lot of capital looking for good projects—well-designed projects. And engaging them, getting—finding—the profit places for them; they have to make a profit, but they don’t have to own it.” Without reliable, standardized information about fiber projects, uncertainty will keep potential private investors at a distance. At the same time, not all data projects inside city hall require that large, complex systems be purchased at a high cost from the private sector; civic tech innovators can adopt best practices from the private sector while using open-source, widely-available software packages.

Divisions between Planning and Money

Today, in cities that have technology advisors, these advisors often lack any authority over the way the city’s budget is disbursed. As a result, the best technologists in government are often ineffective, lacking the budgetary authority to realize plans for technological improvement. To ensure the progress of city technologies, cities should recognize the importance of technology projects and empower digitally savvy leadership to inform the use of city funds. A city needs a master plan or an office of innovation that can scan all departments, look at all the activities that touch on fiber or data, and then require effective collaboration. But, as one city hall veteran and RCI attendee said, “Folks don’t want to give up their data,” much less their money or control. (He said he got the following response from a city department: “I’ll cooperate with you to the extent my job description allows.”)

Becoming More Citizen-centric

One public servant RCI attendee said:

In the business literature there is a distinction between product-centric businesses—those businesses that drive their competitive advantage from delivering some product quicker, better, cheaper

than their competitor. And then there are those businesses that have a customer-centric model where they use the power of data to understand exactly what their customers need and then tailor their products to that customer. Amazon is a good example of that. And I think the way we've set up government traditionally is a product-centric organization. We have stovepipes that deliver different widgets that deliver infrastructure, or health care, or education, or business regulations. And I think we, as government, still need to get better at delivery of those widgets.

But I think what better, more integrated, bigger, more holistic data will allow you to do is to have a citizen-centric organization, where we think about not just delivering widgets effectively, even better, faster, cheaper, but understanding what our citizens need. And I think that we can reorganize government accordingly. Not just have it as a department of public works, but a department of new citizens and a department of the elderly. And then bring whatever resources that need to be there to them. But where government can add value is understanding exactly what the citizens need.

Such a change will require leadership, visibility, and long-term engagement.

Better Marketing

RCI participants believe it is a problem if “open gov” and “open data” are viewed as a fad. The answer to this challenge lies in better implementation and better marketing of results, according to one public sector RCI attendee:

If you don't actually change behavior or do anything with those insights [generated by understanding civic data] it doesn't matter. You need to see things come out of this work. And you do need to market better—tell the stories of the impact of big data, the insights you're having, how those sensors are helping improve the lives of citizens, because if you don't communicate and celebrate those things and share them more widely people are going to see this as this big effort that didn't bear any fruit.

It's important to “show your work” and include citizens in the process.

The issue of fiber, similarly, isn't familiar to key constituents across the country. People say, "If it made a difference that Stockholm and Seoul were so far ahead of us [with regard to fiber], we would be much further along than we are." This is changing, slowly. As one RCI attendee offered, "People realize how essential high-speed Internet access is to their lives and what they get is crap, and it's really expensive."

Leveraging Key Moments

Current communications-policy discussions largely focus on net neutrality. While net neutrality is a critical policy issue, it is a symptom of a concentrated market and not a solution to the country's upgrade failure problem. Leaders in this area have to find ways to persuade citizens that tomorrow can be better than today. The future, after all, belongs to those who give the next generation reason to hope. Leaders should be aspirational and go beyond the limited imagination the current consumer demand represents. (As Henry Ford may or may not have said, "If I had asked people what they wanted, they would have said faster horses.") One RCI attendee told us:

If citizens aren't clamoring for high speed Internet—I mean that doesn't mean that we shouldn't be trying to provide it. It's sort of like figuring out what is going to make cities more competitive, more prosperous in the future and recognizing that there's a need for it and trying to not only educate them but also recognize that even if they're not clamoring for it, it's the right thing to do going forward.

When considering franchise agreements, taxes, and other policy changes, every time there is a public policy point of leverage leaders will need to direct attention to how their next steps will create public goods. This will not be easy.

Technology: Creating and Destroying Opportunities in Journalism

Technology makes new tools available to journalists, especially when it comes to covering public events and using data. But if there is no sustainable business model for local journalism, then there will not be a critical mass of journalists. Without trained journalists, the news will be extractive and citizens will see only public information. If fiber advocates aim to enhance the practices of local journalism, public accountability, and civic engagement, then the big question remains: How can technology help local journalism establish a more sustainable business model? Policies that connect fiber upgrades to subsidy plans can provide answers, but they will be difficult to advance and implement.

Collaboration Among Adversaries

The Responsive City vision for jointly enhancing fiber, data, and journalism assumes that governments will support the development of technologies that allow media to better cover those same governments. There may be plenty of local governments interested in expanding fiber but not in being more closely scrutinized. While many governments tout their open data programs, those programs rarely release data that would reveal problems of public interest within city agencies. Journalists and governments must find a way to collaborate, while still allowing journalists to cover government activity critically.

Framing High-capacity Internet Access as a Critical Resource

Internet access is more than entertainment—people increasingly use the Internet for critical political, economic, and social functions, including access to public services and avenues for political participation. But there remains a broad public impression that Internet access is primarily a luxury. The case for investing in fiber cannot be made if people continue to see high-capacity Internet access as non-critical. This does not mean that entertainment cannot also

live freely on the Internet, though. We built the highways because we wanted to promote commerce, and if malls were constructed along the way that was an added benefit. We need to think about fiber the same way and shift the conversation toward a broad consensus that high-capacity Internet access is essential for life in cities in the twenty-first century. Using (or creating) examples from data-driven cities will help.

VI. Future Collaboration

In the face of shared challenges and common goals, workshop attendees had many suggestions for collaboration across sectors and localities that a university center could facilitate.

Trust and Privacy

Cities should lead the charge for thoughtful data usage policies as a key political issue. As cities collect more and more data about citizens, it is critical that local governments remain trustworthy. Indeed, building civic trust will have consequences that go far beyond support for data collection. Cities confront grave challenges stemming from inequality, economic dislocation, climate change, and other issues. A trusted city will be able to take the major steps to address these problems. By publicly (and actually) positioning city governments as developers of balanced policy perspectives, cities can make progress on these thorny issues.

A university center could help inform cities' efforts on behalf of balanced data use through research on key legal, political, privacy, and data security dimensions of urban data analytics. In the process of ensuring the privacy of public data, governments could collaborate with their private sector partners to guaranty that policies in industry are held to an equally high standard, promoting the diffusion of best practices for public trust and data privacy.

One private sector RCI attendee said:

This is something that cities need to take loud leadership on; not just leadership in policy but loud leadership. That will help a lot, because right now the advocacy groups in Washington that work

in this area on behalf of the industry are bearing the [brunt of responding to all the] privacy issues and [making the] efficiency arguments and talking about all the things you will all be doing. And that means at some point there may have to be a retrofit, and better to do it now and build the trust with your citizens up front than to initiate all these projects and find that they don't trust using the things you make available to them.

With security, again cities need to show their work. A RCI attendee told us:

Dakota County in Minnesota just completed a test where, because of their incredible fiber network, they have redundant connections with two different data centers. And so they turned off electricity to one of them in the middle of the day to see what would happen. And they were able to migrate everything instantaneously over to the other one with no loss of services. And so in the event of catastrophic events, I think the responsive city has to make sure to keep the lights on.

A university center could help spread and promote these best practices.

Benefits of Fiber Investment

Advances in data and infrastructure will require significant investment of both tax dollars and private capital. For data and fiber advocates, the benefits of such investments are obvious: Government can better serve citizens it understands more precisely; predictive analytics can guide strategic investments in transportation, policing, and health services; and fiber high-speed Internet access for the public yields economic growth for communities and regions. But these benefits must be clearly demonstrated and communicated to elected officials and private investors.

A university could provide evidence of the potential benefits of fiber, both in terms of dollars and softer gains. Documented evidence along these lines could then be used to make the case for investment in urban technology. With this evidence in hand, both public and private partners can begin to develop a model for collaborative investment in next-generation infrastructure.

Private entities may not be aware of how lucrative it can be to offer dark (unlit) fiber services in metro areas, for example. Local governments might not know how very successful municipal projects focused on internal city fiber (connecting public buildings) have been—just in pure savings, without even taking into account operational efficiencies. “Unless the phone company is giving you services for close to nothing,” one RCI attendee and fiber expert told us, “internal government fiber will pay for itself in a relatively short period of time.” And no one has yet tied the benefits of a more fully responsive city government to the presence of fiber connectivity. These stories need to be documented and disseminated.

Better Policies

A university center could help cities develop and promote enforceable “dig once” policies to make certain that fiber developers can take advantage of any opportunity to lay fiber when the ground is open for other purposes. Cities could also work with landlords to develop policies that promise access to standardized in-building points without extracting fees, so that competing retail service providers can offer fiber access to tenants. Such actions require extensive upfront engagement in political negotiations, followed by ongoing monitoring and collaboration. Similarly, a university center could help cities develop and promote data use and dissemination policies that could make the relationships among data collection, open data portals, and policy-development plainer and more functional.

Convening

While cities and nations face different challenges, there is much to be learned from one another. Best practices shared and modified to fit new regulatory environments and lessons learned the hard way in one place can be used to preempt difficulties in other localities. It is critical that fiber and civic technology knowledge continues to be shared across boundaries—both domestic and foreign. A university center could play a helpful role in ensuring that these

knowledge flows take place.

Attendees

Local Government as a Technology Leader

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Tom Glaisyer, Program Director, Democracy Fund

Brett Goldstein, Fellow in Urban Science at Chicago Harris

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Joanne Hovis, Director, CTC Technology & Energy

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Scott Shapiro, Senior Advisor to Mayor Jim Gray, Lexington, KY

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Gigi Sohn, Special Counsel for External Affairs, FCC

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International Perspectives on Fiber Internet Access

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