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PANEL 2 - The Status and Adequacy of Advanced Broadband System.

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MS. GEDULDIG: Everyone, let's get started. I'm Karen Geduldig. I'm the Director of the Office for Telecom at the Department of Public Service. And I am joined with Joseph Yakel, who's the Utility Supervisor for Network Reliability, also at the Office for Telecom. So Joe and I work together five days, sometimes six or seven days a week.

So thank you to our panelists. This panel is a big one. And we are hoping to get some really good discourse on the topic of broadband. And we are going to address this panel similarly to this morning's, which is to start with some questions, address them to maybe one or two of the panelists and let the conversation go from there.

So the first question we have are around what advanced communication services are. I think we talked a lot about them in our factual assessment. But if we are going to talk about barriers to deployment and lack of access across the state, I'm curious how people define advanced services from terms of

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are there defined speeds, functionality, capacity, and how are industry and consumers and economists thinking about what is an advanced communications service. We'll start with, let's see, who do we have here, maybe Susan Crawford.

MS. CRAWFORD: Well, thank you very much for having me here, yes.

MR. YAKEL: And you push the button and the light will come on and the mic will be on.

MS. CRAWFORD: Okay, great.

Okay. I'm delighted to be invited. I'm glad to be here to speak to you all. I am an academic. I have no clients, no consulting arrangements. And my life is supported by my salary at Harvard and my work as a columnist. And everyone academic that you talk to should answer those questions before they testify before any public body.

What are advanced communications services. Well, the staff has tried to describe the situation in their recent assessment, but I'm quite anxious about that

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assessment because they appear to be operating in the dark, including relying on industry provided data that basically everything in New York State is going fine and the industry is moving ahead. And they appear to be living in a vacuum. The data isn't tested. We're relying completely on what the industry says. It is often highly inaccurate. We also have absolutely no pricing data for what people are paying for services on the ground. Which is a terrible problem for New Yorkers.

So, in fact, with some bright exceptions stemming from a few nonprofit public open access middle mile networks and communities using those open access networks to bring fiber to the home in New York State, the connectivity picture in New York State is dismal. It's uncompetitive, it's stagnant, it's second rate, and now it's burdened with a mostly useless grant program. The grant program excludes from its area any part of the Time Warner Cable franchise territory. And also any area that could be supported by CALF funding, meaning that most of the state can't apply for those grants.

So this map shows what's going on in New York State. And I'll hand out copies if anyone wants them. As you can see, most of the state has one color attached to it. These are the places where there are 25 megabit per second connections available, and where there's only one choice of that connection available. So the brown is only one choice. And the yellow shows the places where there are 25 megabits per second available with two choices of providers. So you see that a lot of New York State has no opportunity to purchase 25 megabit per second download services, which is what the FCC is defining as broadband these days.

MS. GEDULDIG: So, Susan, I'm curious, sorry for interrupting, but are they 25 megabit speeds, is that the definition, or is that what -- is that the definition you are using for what constitutes an advanced communication service?

MS. CRAWFORD: An advanced communications, this service today is fiber optic connection, with wireless for the last fifty feet when necessary, scalable, unlimited capacity, at an inexpensive price. Governor Cuomo has set his definition as 100 megabits down, ten megabits up. That definition is sorely lacking in a couple of areas. One, it's not about fiber, it's not symmetrical. And we've got a big problem defining as advanced anything carried over copper or over the cable highway provider co-axial connection. So advanced communications today is what we need and will need for the future to scale into the medical imaging, video-carrying productive uses of two-way, high speed Internet access connection.

MS. GEDULDIG: So is there any thought that, perhaps another panelist might have some good insight -- well, everyone will have some good insights into what the definition or should there be a definition of advanced communications services. But perhaps, Craig, you have some thoughts about what that could be.

MR. MOFFETT: Well, it's hard to

escape the FCC's definition and now that's it a matter of record, at least for federal purposes. But there is a sense that the 25 megabytes per second level, while we're chasing a moving target, it's also a bit arbitrary, right. I mean the -- what's required to be able to do multiple streams of simultaneous downstream video is actually -- 25 megabits per second is actually ample to do three simultaneous streams of HD video. And so lots of people would say that's actually more than what's required. On the other hand, once you break the realtime constraint and say, you know, it's easy to say I want to be able to stream live video. But if you say I'd like to download a movie before I go to the airport, waiting an hour and a half to download a movie, which is realtime, is not a satisfactory answer. But then it becomes almost impossible to answer because there are no real benchmarks. And I think that's why you find policy makers everywhere really struggling with this question of what is sufficiency if this day and age. And it's a -- and it obviously creates an additional policy problem in that if you define sufficiency as a high number, then by definition it's going to create a much bigger and more problematic separation between rural and less rural areas. If you define it as a low number, you will inevitably be labeled as a Luddite or not fast enough. There is no good and there is no clear answer. And it's frustrating in that regard.

MR. YAKEL: Thanks for that.

I'd like to tie it into the second part of the question, and maybe, Jeff, you can address this. But you talked the advanced network and regions of the state that may lack access. Can you talk about the VOIP program, you know, and some respects -- with respect to what you've seen in review of the state of technology.

MR. NORDHAUS: Sure. Thank you very much, and thanks for including me on this panel. And I'm glad this panel is starting off with a bang, it's not starting off boring at all.

I was thinking, I went to the same school as my professor, so it's always dangerous to disagree with a professor, especially a Harvard Law School professor. Probably get a bad grade or something.

MS. CRAWFORD: It depends on the question.

MR. NORDHAUS: But I really welcome the comment. And I think that, you know, the underlying theme is the same. I might disagree with a couple of the details, but the underlying theme is the same, which is we need more broadband. We agree.

I work at the Broadband Program Office. And Governor -- I work for the Governor's office through ESD, and I'm helping create the New NY Broadband Program. The New NY Broadband Program is a $500 million program created by the Governor to improve the state of broadband here in New York. And if you look around, and I, again, I stand corrected I'm sure on any of these points, I hope there are not too many, though, that the -- no state has come close to this level of commitment to improving the state of broadband in terms of, you know, $500 million. A lot of states have talked about oh, we want more broadband or we should do, you know, more of this or more of that. But in terms of actually putting real commitment, real dollars behind a program, this is truly unprecedented. And why is that. Well, there are a couple of reasons.

First, the Governor views that broadband is essential. It's no longer a luxury. Someone was talking about speeds of NetFlix. This is no longer about NetFlix. This is not a luxury, this is a necessity. When you look at 98 percent of students are using the Internet in school to complete homework assignments, and about half of those need the Internet at home, effective broadband speeds at home to complete those assignments. There was an article this week about the homework gap or the homework divide. It's not enough to have a student be able to access the Internet in school, and then they go home and students can complete their assignments, some can't. That's unacceptable and that doesn't work, and that's an underpinning of it.

The Internet is also essential for adults. If you look, a majority of adults seeking, looking for employment used the Internet as a way to find -- to help as a tool for seeking a new job. And a majority, I read a study, a majority of those said that online was the critical tool that they used to actually find that job.

So in New York we believe that the Internet is no longer a luxury, it's a necessity. It's the underpinning of a modern economic system effectively. And it's for that reason that Governor Cuomo has truly embraced broadband and the Internet as a essential to his administration. The Governor prior to, I joined earlier this year, had already committed more than $70 million to expanding broadband network, and now $500 million, which will be partnered with the private sector, a billion dollar commitment, obviously takes that to a new level.

In the recent grant proposal that was released we attached census blocks. And the census blocks were derived from the FCC's 477 data, which, you know, isn't perfect. We agree that data isn't perfect. It's what we have. We hope maybe through team work and working together we can improve that. Because we think it doesn't need to be improved, but one served, all served is a big issue. But we took all the unserved census blocks and reattached those to the RFP, and we'll be awarding funding to providers who are willing to provide and willing and able to provide service to currently unserved areas. So for students who don't have the ability to do homework, for people who can't look for jobs, who for people who can't access the Internet at home, I would disagree that that grant program is useless. I think that is very useful. And I am very committed, and our whole team is working tirelessly, is committed to making sure that any community in New York State that does not have access to broadband will have access to broadband by the end of 2018. Frankly, we wish we could do it faster, but, you know, these things take a while to roll out. So I know I maybe diverted slightly from the question, but I wanted to give a little bit of background.

In terms of the speeds necessary for a modern communication network, the Governor has set forth, as mentioned, the 100 megabits as a goal. He didn't stipulate an upload goal, but 100 megabits, and in the most remote areas 25. I think a lot of folks, and I go out and speak to a lot of communities, would agree it's better to have something than nothing. If you're in a community, and I see some of our leading community representatives here, and providers as well, if you're in a community that has nothing, you'd rather have 25 than zero, and you probably think it's more important to have 25 than somebody who has 50 going to 100. And we agree. We think that we can't have communities left behind. And that's really what the program is about, to achieve the goal of the speed goals that articulate of 100 or better or 25, through the grant program. But that only goes part of the way. We need the private sector, we need leaders across the country to continue to speak out to move that program forward.

So at any rate, with that I'll turn it back to, maybe I've answered more than the question, but hopefully that was helpful.

MR. YAKEL: That was great, thank you, Jeff.

So, John, I think you might have something you want to offer us on this.

DR. MAYO: Sure. So I'm an economist, and you normally don't invite an economist in the room to give cheery news, normally it would be the economist that would be one to give dismal news. But I do think that in this particular instance we have the opportunity to be a bit cheerful and less dismal. In the case of looking at the data and the data that are government provided data, we know that, looking at the staff assessment, that currently 95 percent of the state's population has access to 25 megabits or greater. That's the data from the staff report. If you look at the most recent national broadband map data, and look at the combination of urban and rural consumers in New York, it's over 98 percent of New Yorkers that have access to 25 megabit speeds or more.

So I think that's very good news actually. And there's been a number of benchmark studies that have shown that in New York that rate is greater than in other states. And the number of choices is greater in New York than it is in other states. If you look at, again, the latest data from MTIA and the Federal Communications Commission, you'll see that over 90 -- well over 90 percent of the state's population have access to three or more carriers that provide data at 25 megabits or greater. So I'm a little less pessimistic than maybe some.

MR. YAKEL: Thank you, John. And I think you bring up some good points. Now, in the staff assessment, we do have maps, we do have graphics. And, you know, one of the things to point out is New York State is blessed with a vast geography. We've got metropolitan areas, we've got suburban areas, rural areas. There's over 1,450 municipalities in the state. And, to your point, the vast majority of them have wired networks, one or more wired networks. And when we talk about advanced cable networks in particular, we're looking at nearly every single community in New York State, whether it's the metropolitan area or the very rural area, and most of those networks are providing services at 25 megabits per second.

To your point and also to Jeff's point, with the program we're about 95 percent or more there. And I think what we're looking at in programs like EPOs and the Governor's New NY program is to start filling in those gaps to get additional network and services.

(Cross talk)

MS. LERNER: Might I be heard? Susan Lerner from Common Cause New York. I'm sorry that I got here late, but there wouldn't have been room for me up there anyway.

I would have to contend -- contest, actually, this strong congratulatory feeling. A lot of it depends on what data you're looking at and how granular the data is. And what we've seen, and what I think the hearings which the PSC conducted around the state shows, is that the federal data provided by the companies is simply not granular enough. It would certainly be news to many of our members at Common Cause and other consumers that we've heard from, quite vociferously, that they had access to more than one carrier, or that they had access to broadband speeds over 25 MBPS. That would be news to them. And they would laugh at me if I said but the official word is that you have everything that you need. So I think there are some very substantial gaps in how the data is collected and reported. Which is one of the reasons why we believe that an evidentiary proceeding is necessary.

And the question of what the speeds should be, I agree certainly the people who have nothing would be grateful for 25 MBPS, but within five years they will be pounding on everybody's door saying everybody else has 100 or 300. I think the network that is going to be built now is the network we're going to

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live with for ten or 20 years. So if we're low-balling it, then we have put ourselves even further behind in the international marketplace. Because while, you know, what we're hearing is that these are adequate speeds, these are lower speeds than most -- than technologically advanced companies -- countries that we are in competition with. And to the extent that there are faster speeds, they are much more expensive than they are in other countries.

So the question of symmetry is also important, particularly when we're talking about upstate locations or we're talking about rural locations. Not having symmetry absolutely is a disincentive to the entrepreneurs who would be creating content that needs to go up and can be very data heavy if it's video, if it's programming. There are all sorts of ways in which people could be working from remote locations, and they are not able to do that unless they're given symmetry.

So I was frankly very struck by a

comment that was made in response to the VPO's RFI and analogizing our choices as whether we were going to build a interstate highway system that was open for all and that engendered a tremendous amount of creativity and competition, or whether we were going to stay with a railroad model, which was very limited and not open for vigorous traffic.

MR. YAKEL: Thank you. And I think that dovetails nicely into our next question that we want to present for the panel, because you're talking about building -- oh, sorry.

MR. ARON: Thank you. I just wanted to point out that during the discussion, one of the things that gets left out in that discussion is the entire wireless industry. So we talk about advanced communications networks and what that means. And I don't find that there's a whole lot of folks in the world clamoring to sit still. They're not. You know, as every one of you leaves here, you're going to be interacting with your phones if you're not already doing so right now. And if you are, look up. All right, that didn't work.

But when we talk about advanced communications networks, the part of the discussion that gets missed is folks want to move around. The example that was given is we don't want to be waiting to download while we're -- we don't want to be waiting to download while we're on our way to the airport. Our industry makes sure that you don't. I mean, the mobility factor is something that's unique, and it needs to be acknowledged. So if we're going to have a definition of advanced services, we need to make sure that how we define it is technology agnostic and it's responsive to the desires of the market.

When we look at what we're at the cusp of, which is the growth of 5G, and even before we get there, you know, and I can talk -- I'll talk about this probably a little bit later, but the growth of speeds that we're at today, there's every reason to believe that either before we get to 5G or certainly by the time we get there we'll be satisfying the speeds that are being discussed. Yet, the entire discussion is a wire to a house or a business, and nothing else. And, you know, in a world where everybody, again, is not clamoring to sit still, there's some logic to making sure that the definitions acknowledge the desire for mobility.

MS. CRAWFORD: Just a technical note on that. In order for those 5G connections to work across small cells, they're going to need fiber. And Verizon says this right and left, they'll need fiber going very deep into the networks. So we're not at cross purposes here. The wireless industry also needs fiber. Stockholm was the first place to have four competing LTE providers because they had fiber everywhere on the streets.

MS. HELMER: Just for purposes of folks who don't know me, I am Maureen Helmer. For purposes of today I'm representing the cable company -- the large cable companies in New York State, Cable Vision, Time Warner, and Charter. And I want to say a couple of things.

One is an agreement with a couple of speakers that the speeds should be set by the consumer and by the market and not from the top down. Consumers know what they want, they see what's on the horizon, they see what they can get from other competitors. The companies that are investing are looking at what consumers can get from other competitors, and will respond to that. And that gets into our second question, so I'll stop there.

In terms of the PSC study, I'm no longer paid to defend the PSC staff, but I can tell you, just watching the information requests that went back and forth and the amount of work that all the parties did in response to questions from the staff about what I consider very granular data, they weren't just looking at FCC 477's or what have you. A lot of research was done, and very good research was done. And what that study concluded on all the platforms, video, voice, broadband, et cetera, was that there are not only multiple platforms, but multiple providers for all of these services.

And also, just to respond quickly to the idea that fiber is the only solution here, I mean clearly fiber has enormously powerful attributes. The cable system started investing money in broadband before most of the rest of the industry was. And it dealt with the technology it had at the time. In the meantime, it has spent a lot of money, again, all private investment and money from private capital, in enhancing those networks and adding fiber to backbones and putting fiber farther out into their area, and they are serving rural areas. They are serving areas all over New York State. You know, no one argues with the fact that there are still places that don't have service. I think, you know, a couple of references have been made to the fact that Time Warner has made an enormous commitment as part of its merger conditions to serve out to enormously rural areas in the state. And the exception for Time Warner out of the broadband program is for that very reason, is that a private company is going to put private capital into making sure that broadband gets to some of the most remote areas of the state that don't have it right now. So, you know, I don't think you can discount anything less than fiber as being an advanced service because it's providing, you know, very good speeds in very large areas of the state. And as demand is there, fiber will go out to it.

MR. YAKEL: Thanks, Maureen.

And so I want to try and take a couple of different comments that were made here by Susan and Ben and yourself, you know, talking about this next question, which really comes to the heart of getting networks to places where it's not now, and advancing the networks, and that's the investments. How companies are deciding what money to invest, where to invest it, the technology to invest it in, whether they're going to do some upgrade to an existing network, are they going to build a complete new network. We've got companies operating in New York State that are intermodal that have a -- that operate a wireless network and a wire line network. Some, like Verizon, which are running two wired networks in tandem. Obviously we've got a finite number of customers in the state. Whether that customer is the individual using a cell phone, or if that's a residential premise or a business, we've got a fixed number and we've got a lot of companies that are operating in this environment.

So let's talk a little bit about that, the network investment, the decision making factors that are going into it, and how do you relay in or retain reliable services over those networks in this competitive environment where at any given time somebody may take your customer away. How about Craig, could you start with that?

MR. MOFFETT: Sure. And by the way, I didn't introduce myself last time. So I operate my own firm, MoffettNathanson, which is a independent research firm, primarily in the financial markets. But, like Susan and like an academic, I'm not paid by any of the companies, for obvious reasons, that I cover.

So my goal is simply to try to make forecasts. And in that context the -- we've actually looked for quite a long time at the returns for building fiber. In fact, full disclosure, in my prior life, so going back almost 20 years ago now, back when I was a consultant, I was an advisor to what is now Verizon, doing analyses on the inside of the company at fiber deployments.

And the challenge has always been that the returns on investment to be the second player into a market are very problematic for building fiber networks. You'll recall that the largest the country has seen by far is Verizon's FiOS project, a lot of which was here in New York State. But FiOS, when we analyzed it in 2005 and again in 2008, never came close to covering the cost of capital and was a money losing project. It's no longer a terribly important debate. It's relatively clear that that turned out to be the case.

And there are a lot of inputs to the equation. The inputs are I think often assumed to be the affluence of the community that you're serving on the demand side. In fact, that's actually one of the less important ones. The most important ones tend to be supply side issues about the cost to reach a particular home.

It is not, by the way, as many people would submit, always correlated with higher density, meaning equaling lower costs. In fact, that's often the inverse of the case. It does tend to be the case that it is cheaper to deploy with aerial plant rather than buried, as you can imagine, coming in from a telephone pole is cheaper. But other factors, like the number of trouble reports per thousand lines in that given geography end up being very important. That is, replacing copper when the worse condition the copper is in, the more economically attractive it is to replace it with fiber and vice versa. And so all of those considerations factor in.

It got a bit easier for companies to earn a return in the Google model. And arguably it's because of Google's brand name.

But Google, when it went to Kansas City, was able to deploy under a model that they called demand aggregation. Which I think prior to Google would have been probably criticized as being red lining. But demand aggregation was simply we will build it in the places where we have a commitment to a very large percentage of that community committing on a block by block basis. Even with that benefit and with lower costs associated with the fact that they're now using bendable fiber, which makes the labor costs lower than they used to be in the Verizon FiOS days, it still doesn't appear that Google is earning an acceptable return, that is, a return above the cost of capital, in the places where they have built so far.

Now, Google is building in a lot of different models. They have built -- in Kansas City they used a largely preexisting fiber backbone, but the drops were organic. In the case of Huntsville, Alabama and Provo, Utah -- they just announced Huntsville the day before yesterday -- they're deploying on a model of a preexisting network, and they're effectively reselling and in some cases refurbishing the existing fiber infrastructure. In Atlanta they're wiring only apartment buildings. A lot of what they're doing still has the feel of an experiment rather than a large scale project.

But as best we can tell, even Google is not yet earning or -- and by not yet I don't mean that the phase of the project, but they still haven't found a model that generates a sufficiently attractive economic return that you would be doing it simply for the sake of it's a good investment. They have other axes to grind, which are primarily regulatory, and trying to shape the regulatory debate. But as an economic investment it is a problematic one.

MR. YAKEL: Thanks, Craig.

So let me ask this to Ben Aron in a slightly different way. When we talk about wireless, when we look at the LTE network and services that are available in New York today, so over 80 percent of the state is blanketed with wireless broadband service. If we were to look at that map just about two or three years ago, there would be hardly anything on there at all as far as LTE. So I want you to, Ben, if you can, talk a little bit about the investment on the wireless side of the house. We've got four national wireless carriers, and all of them are providing service in New York State, and they all deploy LTE services to one extent or another, with some providers covering the vast majority of the state. And what we see when we look at the unserved areas are those areas that have historic spotty service, those largely in the Adirondack and Catskill regions, the forested areas. But could you talk about the type of deployment that the wireless companies are doing, and even looking forward to things like 5G and advanced networking, when you've got a very diverse customer base from the suburban area all the way to the very rural, like New York State.

MR. ARON: Sure. Fundamentally, you know, what the wireless companies are doing is looking at what the demand is today.

And the demand today is mobile data, mobile video being the primary driver. And the projections out are somewhat staggering. So we're looking at a projection from 2015 to 2020 of a 600 percent growth in mobile data. Today's 60, or I guess it's actually now last year, but 2015, 61 percent of mobile date was video, and that's projected to go up another 16 percent to 77 percent by 2020. So, you know, we're looking at a crash of data that's coming down the pike on our networks. So, you know, the thing that we need to keep in mind is how do we keep up with it. For every network instruction, you're really looking at three primary drivers, spectrum being the obvious one, network, equipment, and access to infrastructure being the next two big ones.

So spectrum. We've spent $94 billion on spectrum in auctions since the inception of the auction process. So we're -- we've invested heavily, heavily in spectrum.

The type of spectrum that's available has different characteristics. If you look at the original cellular allocations,

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the A and B, the cellular A and cellular B blocks at the top of the 800 megahertz band, the propagation characteristics are terrific. They go -- they propagate quite far away from the towers. Seven hundred megahertz auctions, that spectrum propagates even further. And the TV signals, the TV auction that's coming up, I think at 600, that will, again, propagate even further.

Those lower band spectrum also tend to go through buildings. So they are what you might call the work horse of any network, and they're going to be attractive options to build networks on. But beyond that, you still need other spectrum. And mid band spectrum being a great available option, between one gig and, you know, four, five, six gig, to fill out the networks as you can. And then the high band stuff that's going to be coming online, millimeter wave technologies, you'll hear that term a lot, that stuff will be necessary as well for high capacity operations.

So on the spectrum side we're

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investing, you know, tremendously. However, the hang up there, of course, is that it is a 13, I believe the number is 13 years, certainly over a decade for spectrum to be identified and brought to market. So you can't wait for it, generally speaking. When it becomes available you get it, but planning to wait for it is probably not a very good idea. So the alternative is to build more network. And the term you hear a lot of these days is densification. And really what we're talking about is adding sites. But in an environment where, if you look at the coverage maps, the point was made that, you know, we cover 80 to 90 to 95 percent of the population of the state -- I think the Commission's number showed 95 percent in a study -- you're obviously not going to be -- not going to be as pressed to add coverage, so you're going to try to add sites. More sites add more capacity to the network because each site passes less traffic compared to, you know, an area that's covered by one site, covered with all the traffic, five sites would carry 20 percent, give or take, of the traffic.

So there's this interplay between the availability of spectrum, the ability to build out network equipment, network sites to add capacity to the network, and then there's an interplay between adding coverage area that you know you're lacking, and adding capacity. And the one thing that's almost certain is you never have a lack of demand of either. There's always some spot on the map that you could try to cover a little better. There are always areas that are in need of further capacity. So there's not a time period where we say this is great. We just finished with our capacity build and we are going to go ahead and build out the rest of the coverage. It just doesn't happen. People -- what we've seen is, again, 600 percent data growth. People are just using more and more of it as we make more and more of it available. So as quick as we have the ability to invest, we are investing. And it's an intensive process.

The network equipment, you know, and the spectrum relate to each other in a highly technical manner, and that is, you know, the coverage footprint. So as you go higher into the spectrum bands, the signal gets less and less distant from the tower, it propagates more poorly. So that means that while it's extremely useful, it's limited in its ability to provide coverage area. And, unfortunately, the majority of spectrum that will become available is going to be in the mid range and the high -- in the mid band and high band spectrum. So from a pure coverage spectrum, you know, it's more challenging with those spectrum bands.

And then the last piece of it is infrastructure access. So all the spectrum and all the network equipment is actually in the end fairly useless if you don't have a place to hang an antenna. So in hanging antennas, you know, the old system, the old process, everybody remembers the fight over siting for towers. And those fights still exist, and we do need macro towers. But the majority of the footprint has been covered, because we have a lot of land mass covered.

So the, you know, the next things that we're looking at are rooftop sites, we're looking at utility poles, we're looking at right-of-ways. The state parks that were discussed and coverage challenges in there, we're trying to get to those. But the things that we can control obviously is spectrum. When it's available we can buy it. Network equipment, we can buy it and deploy it. I'll leave it to Craig to cover access to capital and how that interacts, I'm not even going to go there with him on the panel.

But the part of it that we don't control is the access to infrastructure. So take a look at poles, for instance. They're regulated in New York State by the New York Public Service Commission. And what we need really at an accelerated pace as we try to roll out sites that are closer and closer to the customers that we seek to serve, both due to the need for capacity and due to the spectrum that's available, we need to have a defined process that is known, that has a time line that makes sense, that allows us to predict time to market, that doesn't allow endless squabbles over either the rates or the terms and conditions. It needs to be a defined process with a known beginning and a known end that allows us to get advantages of time to market. And all of those things come together. So when a -- when the regulatory, you know, whether it be zoning, local zoning authorities, whether it be poles, whether it be right-of-ways with the state, when those are all, you know, facilitated cleanly, then the investments become more -- more easy. So you're not looking at -- you know, Atlanta is a lot easier to build in or San Francisco is a lot easier to build in. So as a national carrier I'm going to focus where I can actually get something done and plan on catching up, when the very difficult -- and mind you, I'm not saying that New York is or isn't difficult, I don't have any of the numbers on that, but when you look at it from that perspective, you end up -- you know, the ability to actually deploy, if it outpaces the ability to plan those places where you're hung up, you're probably going to skip them and get back to them, you know, in the year and a half or two years it takes to get done with the zoning fight.

So, you know, that's a lot. I'm not sure, I probably got pretty far off from the question, but that's a pretty good starting point.

MS. CRAWFORD: I just want to add in here about -- there seems to be some idea on the panel that there's something exotic about talking about fiber connectivity. Here's the problem. Because there is so little competition in New York State, these private actors that exist right now have no particular incentive to upgrade their networks. In other parts of the world, so we always talk about Seoul and Hong Kong and Tokyo, but also Paris and Riga and Bucharest, and even in little tiny towns in New York State, like Naples and Bath, you can get a cheap fiber to the home connection. Now, why is that? That's because, as a matter of policy and as a matter of long term thinking, the companies in the area decided that it was worthwhile to invest in open-access middle mile fiber networks to which anybody could connect, right. You put those open-access middle mile networks in -- and lots of New York companies are interested in investing in this because the private actors have no particular incentive in the existing incumbent market to do it -- put those open access networks in, and then a last mile network can be built quite cost effectively to very tiny towns, and provide fiber to the home connectivity for very little money.

So these problems all weave together, because the market is so uncompetitive in New York State. Existing companies have no reason to upgrade. The thing that needs to happen is not rocket science, it's just financing for middle mile access networks, and then helping towns aggregate their assets and interest and money to make sure they have a plan that works for the long term investment into fiber. Fiber may feel expensive, but that's only because

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you're thinking about a five year return. Over many years it's 30 percent cheaper than copper to maintain, and it can be upgraded infinitely.

MS. LERNER: And that's where the PSC comes in, to talk about the consumer, not from the industry point of view. If you have that kind of competition, if you've got an open middle mile and competition to the final mile, then you are actually going to have market choice.

Because I'm afraid I disagree with Maureen. The consumer isn't making a choice that they want less speed. The consumer is making a choice of I can only afford this. And when you compare the cost of high speed broadband, truly high speed broadband here in New York State and in New York City, it's interesting. It's provided by Verizon, and the price is exactly the same in all of the places that Verizon provides that speed. According to the Open Technology Institute it's 299.99.

Now, it's interesting to look at

Tokyo and it's interesting to look at Seoul for the -- for double that speed, consumers in those very dense and hard to build out cities are paying $30 or $39. This is really I think an example of how we need a advocate for the consumer, not for the customer. I'm struck how the statute does not talk about customers. The statute talks about consumers and the public interest to providing what has become a basic service. And it should -- to me this discussion should be much less about how will we get the companies to invest so they can make more money, and it should be from the consumer's point of view. And I'm concerned that we're really not hearing that.

MS. GEDULDIG: So I think I'm going to skip question three, which is an important one and I'll come back to it, but I think there's been a lot of commentary, both in this morning's panel and today, about choice. And we hear from some panelists that there is a lot of choice and some from other panelists that there is not a lot of choice. So perhaps we can have a little bit more detailed conversation around what is competition. How are the panelists here defining competition to say that there is or is not sufficient choice. And I was just about to ask Susan Lerner to speak to that, because she talked about it so much, and now that you're done drinking I will ask.

MS. LERNER: Okay, thank you.

I would define choice as having multiple providers providing high quality, reliable service at multiple affordable competitive rates. What we don't see in New York is true competition in the sense that there are numerous providers and they are vying with each other to provide high quality service at the lowest possible dollar.

We are falling behind the rest of the world because we have relied on private actors who are making a tremendous amount of money, it's an impressive amount of money that's been invested, but it actually pales in relation to the gross volume and the ultimate profit which the large telecom -- telecommunication companies are earning. So

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it seems that we need to ensure, if we are going to have a competitive marketplace, and this is where I agree with Professor Crawford, we need to be opening up the middle mile and not tying it to large telecommunication companies who have failed to make that investment in any place that is reasonably challenging, and create the fiber and telecommunication equivalent to a interstate highway system.

MS. GEDULDIG: So the --

MS. ZIBELMAN: May I follow up on that?

MS. GEDULDIG: Yeah, sure.

MS. ZIBELMAN: On the middle mile issue -- and welcome, everyone -- the -- you know, Professor Crawford, and I heard you mention Seoul and Paris, but there's totally different regulatory regimes in those countries. It would be helpful if there are other places outside of New York in the U.S. where you could --

MS. CRAWFORD: Well, take a look at Huntsville, Alabama, which, as Craig mentioned

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is just this week, that town is building a -- what's called a dark fiber network, so it's not lit, it has no --

MS. ZIBELMAN: Right.

MS. CRAWFORD: -- electronics going in it. But it's this basic wholesale facility. And now Google has just announced that they will lease capacity from that dark fiber network to provide last-mile connections to residences.

MS. ZIBELMAN: And is -- and so, you know, in Huntsville is it the city doing it or is it the utility?

MS. CRAWFORD: It's both. It's the city working with the utility, that's right.

And there are also towns, there's a town in Maine, Rockport, Maine, they did the same thing.

MS. ZIBELMAN: But do you see any -- I mean, and I'm asking this because, you know, if there are stake -- I know there are individual cities, I mean, we all know Chattanooga.

MS. CRAWFORD: Right.

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MS. ZIBELMAN: There are great examples in the U.S. But do you see anything where there is a jurisdictional where there seems to be a regulatory construct that's being established that you -- and you or anyone on the panel would say boy, New York, you really ought to look at this state, they seem to be --

(Cross talk)

MS. CRAWFORD: Well, Maine has what they call a three ring binder, which is an open access network going around the state. There are billions of them. Massachusetts has its own middle mile network that goes deep into western Massachusetts. North Carolina has a quite successful middle mile network. You see, they're open.

There's plenty of middle mile fiber controlled by Verizon and Time Warner Cable --

MS. ZIBELMAN: Right.

MS. CRAWFORD: -- in New York State. The problem is, they have no particular incentive to lease that to anybody else.

MS. ZIBELMAN: but so you're, if I could -- so your suggestion would be that if we need -- if we're going to build a middle fiber backbone --

MS. CRAWFORD: Yeah.

MS. ZIBELMAN: -- it ought to be built either by a government entity or it would be -- it should be built by a non-incumbent owner?

MS. CRAWFORD: Whoever builds it, it should be subject to the requirement that it's nondiscriminatory and open access. And you'll see all kinds of things happen once that's done.

MS. LERNER: I was going to say that unbundling and requiring nondiscriminatory access would have the same impact as building out by government.

MR. NORDHAUS: We -- these are great ideas actually, I agree with a lot of what's said. But just for point of fact, we actually do have some middle mile networks here in New York State. We have Ion, which received money in a grant program. We have

DANK, Development Authority of the North Country, which has open access, and I believe adheres to those rules. And I guess there certainly are areas of the state that don't have middle mile as well.

MS. CRAWFORD: Right.

MR. NORDHAUS: And, you know, the middle mile concept is very interesting. We actually spend a lot of time looking at it. Because if you think about a community that needs access, you could think about sort of -- and you think, to Craig's point, about the economics of that, providing service there, may not be great. And if you look at some of these very rural areas, the cost to provide service to a customer can be negative. I mean, it can be a cost, even when you take into account the revenue. So you can be losing 50, 60, 70 dollars a month on any given customers. That's why the FCC has the CAF program, because they look at it, these are money losing customers, so they subsidize them, otherwise those people wouldn't receive service at all.

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But in any event, so you think about how to incentivize a private sector or anyone to provide service to their -- I'll just wrap it up really quick and then you tell me why I'm wrong -- but basically you can think about getting -- let's say they do need a subsidy to go there, that they could either get an outright subsidy to go there, or, in a way you could build a middle mile, right. If you build fiber through the middle of a town, you're sort of in way creating a subsidy because they don't have to build the fiber.

So I was thinking a lot about, you know, an effective grant subsidy or a middle mile subsidy -- sorry, a middle mile network, which is kind of in effect a subsidy, if you want to think of it in those terms. Now, that conceptually struck me as kind of an interesting idea. And I'm just speaking personally as I thought a lot about this. But I just have a question for Professor Crawford, as well as others, there are some examples of we saw, for example, in Massachusetts, not far from you, my understanding was that they had a middle mile network that was funded by BTOP, they built it all through Massachusetts through these small towns, and the concept was the same thing, it's an effective, you know, open access, it will be a subsidy, then all the towns will hook up and everyone will have the -- and what happened -- and I'm not an expert on that particular situation, but my understanding is nobody showed up.

MS. CRAWFORD: Right. I can give some facts on that one.

MR. NORDHAUS: So the risk -- and I would love that -- the risk would be if you're a consumer here in New York, let's say that folks in the room got together and said this is a great idea, let's do it, let's build a middle mile network to these four towns, the risk, maybe it's a low risk, is that you wouldn't get -- the last mile people wouldn't show up. And maybe we want to place our chips on that and say you know what, we'll take that risk, that's the way to go, let's build the middle mile and hope they come and connect these homes. But in one, two, three years, if people haven't connected those homes, you still have people who are left behind. And that's just something that is a concern I want to throw out.

MR. YAKEL: So thanks for that. And I kind of want to tie this back to Maureen first and then to John. Susan had talked about the idea of middle mile and cable company networks, maybe the telephone company's network using that. But the real question that we were trying to get at with the first part of this question is about competition being different and is the market producing reasonable prices for broadband services. So, for example, in the cable industry are you looking at standard pricing regardless of service area, and with respect to middle mile, you know, do you feel that the cable industry is offering services at reasonable pricing such that the company has made a business decision that middle mile doesn't make sense for the industry?

MS. ZIBELMAN: Joe, can we just add on too, because I would be interested in hearing from all the panelists, because this is one of the things that we debated, is it a middle mile issue or is it a last mile issue or is it both?

MS. HELMER: It depends where you are.

MS. ZIBELMAN: I'd like to hear from all of you, your thoughts on that.

MS. HELMER: Yeah. It depends on where you are, Chair, obviously. And to the extent that there are areas of the state which do not have service and are not likely to get service, you know, dealing with the middle mile and having a program is, you know, it's a great thing.

But I'm still kind of reeling from the idea that cable companies don't have incentive to invest in their network. I mean, it just -- it's not factually correct. They have incentive, they have invested billions of dollars, they continue to invest billions of dollars. They have every incentive to keep the customers that they have and to get more customers. They compete against Direct TV, they compete against the wireless industry, they're competing an all forms of platforms. Maybe not on all of these in every single part of rural New York, but in the large portions of their areas, they're under intensive competition. And you can see that by the extent to which folks have migrated from either cable service to wireless service or from landline service to wireless or cable service. There is competition out there. Is it perfect, no. But competition is never perfect. But in terms of incenting the industry to invest in its networks, it is a continuous cycle of investment.

The demand for higher speeds continues to go up, and it is being met. Even in rural New York there are -- there are areas where folks have a high demand for high speed, and the industry is meeting it. But in the meantime, there are a lot of barriers. And, you know, we talked a little bit about access barriers, such as getting into buildings. And the Commission has a very good and unique role in terms of orders of entry where it really assists, whether it's telephone companies or cable companies, in terms of getting into buildings, particularly in municipal areas. Pole attachment issues are huge. I mean, they're probably the most boring issue that the Commission deals with, but --

MS. ZIBELMAN: Thanks a lot.

MS. HELMER: But when you're in a real rural area and, you know, you're at that last mile, you're at the farm that's at the corner of the, you know, by the mountain and nobody can get at it, and suddenly you have an issue where you've got a build plant and maybe cross over another franchise that's not yours or that doesn't have a franchise, and suddenly people are telling you you've got to replace all the poles from here to there because, you know, the local municipality is tired of fixing their poles, you know, there are a lot of barriers in rural areas. And obviously decisions are made, but they're also made geographically, you know, with large international companies and particularly multi-regional companies in the United States.

They're -- decisions have to be made as to where to put investment. And the kinds of things that are very important are the level of regulation, are the certainty of regulation, knowing that you don't invest today under a basic set of assumptions and that two years from now it's going to be completely put on its head and go in a different direction. It's taxes. It's pole attachment issues. It's environmental issues. It's all the issues that were raised in terms of the difficulties in putting infrastructure in any part of the state.

So, you know, I just, I cannot say enough the investment is being made in the state. And if you want a state to look at that's a success story, it's New York.

MS. CRAWFORD: Just to talk about the level of competition, because that seems to be a crucial inquiry, we know that if Time Warner Cable and Charter merge, they will face competition from FiOS in just 12 percent of their territory. So Verizon is not overlapping with Time Warner Cable - Charter.

And same thing with Frontier. There's very little overlap between their territories.

People -- where the cable connection is reasonably priced, people will flee DSL, because the capacity of cable for high speed Internet is so much greater, right. So cable is very successful in those markets. And because Verizon is really backing off from doing more with its wires in New York State, not maintaining the copper, squeezing the copper for as long as they can, and not installing any more FiOS, that means that cable really stands alone for these high capacity wires in New York State. That means they're not facing competition, and that means they have no particular incentive to upgrade to last mile fiber. Much of their cap X in prior -- these years recently has been into set top boxes and leasing to premises equipment, not into their basic infrastructure.

So then you say well, what about wireless, is that competitive. And the wireless industry is right to point out that they're going to be able to offer high speeds. But you have to look at very carefully. Does that mean capacity, does that mean the ability to have a lot of bits being used a month at a reasonable price? No. Given usage caps and given the distance, you have to be next to the tower in order to get that speed, and given the price of a wireless connection, it's not substitutable for what you can do over wired. It's clearly complementary and important, and we're absolutely right that it's mobile, it's the future. But without a fast, cheap wire in everyone's home, they won't be getting a world class connection.

MR. YAKEL: Thanks.

And, John, you were going to add something?

DR. MAYO: Sure. I think it's useful to ask the question what is the problem we are trying to address. The problem we're nominally talking about here sort of spans both the questions that you asked, both the competition question and the investment question. But if you -- you might ask under whatever definition of competition that we have, is that driving sufficient investments. And we know that how investments are done, and I'm not an investment analyst or an investment advisor, nor have I ever been in a room when those decisions were being made. So for me anyway it's sort of a more, let's say, two levels, a principle level and sort of what are the good economic principles, and number two, what are the data.

So at the economic principle levels you have to -- I know what we teach MBA students is to invest in assets where the rate of return, the expected rate of return on an asset exceeds the cost of capital. That's what we teach at Georgetown, they teach it at Harvard, they teach it at every single business school in this country. And in fact that's what business people go out and do. And if you were -- and what's really interesting is that if you were to derive an optimal level of investment, because here part of the debate is what's the optimal level of investment. There's an implicit discussion about we're investing, we're not investing enough. But if you were to describe an optimal level of investment, it would be one where the expected return on a marginal set of assets was just equal to its cost of capital. Where the expected return on a marginal set of assets was equal to its cost of capital. That would be the ideal from an economist's perspective level of investment, with one little caveat that maybe I'll come back to.

But that importantly is exactly the incentives that private companies today in New York have the incentive to do -- they -- under a light touch regulatory approach. They have the incentive to expand investment out to that point. And it's led to, and here's the empirical part of this, billions, not millions, not hundreds or thousands, but billions of dollars of investment in network upgrades. And that's manifested itself in faster speeds that exist, and broader coverage that exists. So it's palpable what's happened, right.

Now, there is a point, there is a

point where the returns to investing commercially in geographic areas will be limited. And that is a worthy discussion. If the public decides we need to reach that final two percent of people or three percent or five percent of the people in the state, then we can have a discussion about that. In fact, the state has had that, this discussion, with the Governor and the legislature and introduced the New NY Broadband Initiative Plan to invest $500 million in the state to ensure that extra coverage. And to fund that, and this is an important compliment to the state, to fund that out of the general tax revenues rather than a specific set of customers. It's a great public-private partnership approach. But it -- but just to circle back to my first point is, I'm not sure that we have an investment problem.

MS. LERNER: I am happy to hear you say that because I think we have a results problem from a consumer point of view. If you go into -- if you talk to any of the consumers who answered our surveys, who say that they are frustrated because they cannot get any broadband or adequate broadband, if I were to respond by saying X billions of dollars invested, they would laugh at me. The people in small towns in upstate who say the next block over has high speed broadband but no matter what I do I can't get anything, a response of well, the company invested X billions of dollars and they're not going to invest more is not satisfactory from the consumer's point of view. This is the Public Service Commission. And it's less -- I'm concerned that we are talking very much about an adequate rate of return but we're not talking about reasonable rates, we're not talking about universality of service, what is now I think everybody accepts a absolutely necessity in today's world.

One way perhaps to deal with some of the problems is to address the question of we have a universal service fund for telephone service, for voice service, but, as everybody pointed out in the earlier panel, the voice service that is regulated is going down.

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What's happening to all of that money? Can it be repurposed with a redefined set of basic service requirements to help subsidize the final mile in places where you have infrastructure in one part of the town but not the other.

And also what we've been seeing, from a number of towns throughout the state, is a great desire to build out, to have a black fiber network or to have the middle mile come to their towns and to be able to put together a package. And we're talking about municipalities as diverse as Yeats, California and Syracuse. So I think there are a lot of tools, but we have to be looking at the result and not so much how much money is invested and what's the return to the company. Companies seem to be doing pretty well.

MS. GEDULDIG: So I am jumping around a little bit on the questions because just keying off on the conversation.

I also want to note that Travis Litman from the FCC, from Commissioner Rosenworcel's office, was intending to be here but was stuck on the tarmac as of about an hour ago in D.C. So he sends his regrets. And we'll have to let him know how this went.

But there's a couple of points I want to take off of. One of them was, you know, Susan was talking about wireless and whether or not it's a suitable alternative to wire line broadband, and that is a question we have on here to direct first to Ben. Are advanced wireless networks a suitable replacement for wire line. If they're not, what's in the works and what would need to happen -- we'll start with Ben, but everyone else -- what would need to happen to make them a suitable alternative. And given the increasing demand for band width and wireless and mobile connection, is that something that the industry is looking to do.

MR. ARON: So I think that, you know, to tackle the first part first. So that, you know, is an advanced wireless network a suitable replacement. I think that the answer really is that there isn't one answer. I mean, the answer fundamentally is does the consumer want it to be an alternative, are they going to adopt it, are they going to cut the cord, are they going to take that as their sole service. If they do, if they do, then they've made that choice themselves. So I think in a very fundamental level, and certainly in the voice market, a lot of that is happening. And then I think as the broadband market matures, as LTE -- as the advanced LTE networks get built out we might see more of it. As spectrum gets put into the pipeline and there's more capacity built into the networks, we might see even more it. So I think that, you know, fundamentally consumers need to make that decision. And if they do, then the answer for them obviously is yes.

I think that, you know, and I touched on this before, I mean, mobility offers a use case that is simply not present in terrestrial networks. So the -- part of the question becomes what, you know, what is it that you're trying to do. I mean, certainly if you're traveling constantly, then you're going to want wireless service and a robust wireless service. If you rarely ever travel, then, you know, there might not be as much of a use case and you might simply be able to be home with a WiFi network and that might be adequate.

So, you know, these are -- at a fundamental level these are really basic consumer questions. What do they see as alternatives. Do they see them as parallels that complement each other, do they see them as alternatives where they want to use one or the other. I think that, you know, you're looking really for a technology agnostic answer to that question and leave it -- you know, to leave it to the customer.

And we filed an ex parte letter with the FCC on late January, it was the 22nd. And in that ex parte letter we asked the FCC to dedicate a $500 million annual mobility fund. So part of the prior discussion was, you know, in USF and how is money being spent for that, and the CAF program has just had its, you know, the CAF II just had its initial tranche and then it's going to go to auction.

And in 2018 the FCC has indicated that it would take a look at the extremely high cost areas.

So I think that, you know, A, you need a technology agnostic solution. B, you need the consumers to decide. From CTIA's perspective we think that there should be a dedicated fund for wireless annually. And I think that when all of those factors come together, you're going to empower consumers to make decisions that make sense for them, and you're going to allow, you know, sort of a technology agnostic investment in the market, which would also help.

You know, another piece of this that -- that probably needs to be looked at is the broadband for Lifeline. So the FCC is going to look at whether to add it, in the very near future they're going to address that. And if you look at the voice market for Lifeline, you found a, you know, competition in a market that really just didn't exist, right. I mean, there was no clamoring to serve the low -- the less affluent communities with voice service. It was sort of a backwater. And now you have companies that really are specifically targeting them for voice service. So if you put Lifeline for broadband into the mix, then you might see that there will be, you know, for those less affluent communities hopefully that will develop some competition to serve them as well.

And insofar as that all of those factors are coming together, I think it's an interesting time to ask the question. And I think that if you have a technology agnostic solution or approach to it, then you're going to empower the consumers to make the decisions that make sense for them, you know, and hopefully they make good decisions.

MS. CRAWFORD: Just if I could, very, very briefly, we seem to be leaving price out of this discussion. Eighty-three percent of mobile data subscribers also have a wired home. So if you can afford it, you have both. In countries and places where the wires at home are cheap and fast, people always have a mobile connection and a wire at home.

In America, smartphone only adoption is very tightly correlated with socioeconomic status. And we are at risk of creating two Americas and entrenching inequality by saying to poor Americans, you just go ahead and rely on your smartphone. People don't do the same things using their smartphone. If you tried to swap your usage of a wire into your smartphone usage, you'd be paying $500 a month. So when we talk about substitutability, price has to be relevant to the discussion.

MR. NORDHAUS: Yeah. I mean the three -- I agree, the three factors that we've looked at in the broadband office for, you know, is it a viable is -- I'll just reflect on what you were saying -- is speed, reliability and cost. And there are probably others. But if you look just at -- and you made the point about symmetrical service. If you think about, okay, what -- and we spoke about in the beginning of the panel about what are the speeds necessary, wireless technology is unbelievable, right. I mean, the things that have happened over the last ten, 20 years, the speeds, the capacity with video, what we can get now that we could never get before. And with 5G, those will continue to improve. But for consumers today, you have to say okay, is it sufficient given the needs of the consumers today. So speed is one. Obviously it's not as fast as fiber, although it's used in the backhaul, as you noted.

Reliability. In some of the studies that we've done, some consumers have a good experience, some consumers haven't had as reliable of an experience. It depends on where you live. It's a little bit goes back to the thing we were talking about New York as if it's one entity. You know, New York is not one homogeneous region. Anyone who lives here in the city, they know New York City. But folks who live in Albany, they know what it's like there, and people who live in Plattsburgh or the Southern Tier or Buffalo, where the snow features can be very different. New York has a very heterogeneous geography, there's a lot of different topographies, a lot of different areas. So when we talk about deploying broadband in New York State, there's a lot of different regions to take into account. And so reliability can be different in different areas. It has to do with coverage as well, obviously.

And then cost was spoken about. A lot of the offerings that are out there now do contain a data cap on the wireless side. Probably to a greater extent than the wired side. And so to the extent, you know, you're trying to use it as a substitute at home, if you have a data cap that can obviously be problematic. To the extent some of those things change in the business model going forward, perhaps as a true substitute that would start to align.

MS. ZIBELMAN: So just to follow on on that particular point, one of the things that -- sort of an observation -- it just seems to me that it's the providers, when they come talk to us, talk about having a ubiquitous service, both landline and mobile.

And certainly if you look at the advertising, that seems to be the desire is you have one provider and they meet all of your communication needs at home, on the road, at work, et cetera. And does that -- I mean that sort of in that sense might -- I understand your point about people having to select one, maybe they'd like all but they can only afford one, that they pick mobility because that seems to be the essential service anymore, you know, for a lot of reasons.

I'm not sure where that takes us, though, in terms of where for us in looking at policy. I mean, because that would suggest -- it seems to me that would suggest once you select a provider, and they become your ubiquitous provider, the stickiness issues are going to become even greater, right. Once it's going to be -- when someone is providing your content, your home line and your cell service, moving from one provider to another is going to be highly unlikely.

MS. LERNER: Yes. And also, the ability to negotiate any terms, which consumers in New York absolutely do not have.

MS. ZIBELMAN: Yeah. I don't know if it's a bad thing or not, but it seems like a likely outcome, or desired outcome, in fact, for the vendors.

MR. ARON: No, no.

MS. HELMER: I was just going to say that one of the positives that comes out of that problem, you know, of having multiple services provided by a provider is that you are getting more inroads into areas like rural New York, because there are three or four products that can be sold to a particular consumer, whereas if all that was being sold to that consumer was a voice service, I mean, we saw for years you didn't get any additional providers. But now, because of the multiple services, you do see more inroads in rural areas.

MR. ARON: So, you know, I guess a couple things. You know, one of the things that we benefited from tremendously, or let me touch on two of them. One of them is a national approach, right. So in the most rural areas of the state the rate plans that they're enjoying are the same as they are in the most urban, where we are, right. In Manhattan you pay the same rate for service from the national carriers as you do in, you know, in upstate. So there's benefits there, both on the equipment side, the handset side.

At CTIA in particular we have the CTIA's consumer code, and it is twelve principles that are designed to tackle a lot of these issues. Including one of the recent ones is handset unlocking to enable consumers to do what you're talking about, which is not have this problem with stickiness.

But even as that's happening, you're looking at one of the national carriers bought Direct TV. So, you know, you're seeing that there's a convergence amongst them. And the carriers are, to their credit, trying to find unique ways to, A, differentiate themselves, and B, provide services that are satisfactory on all levels. So they're going to provide at your house, you know, the broadband that's at a higher speed than you might see throughout the mobile network, at least for now. And, you know, the market's trying to solve these problems.

So the light touch regulatory regime has really been working. And it's, you know, sometimes I think frustrating to watch because it can be a slow process. And I imagine for a regulator there's a desire to push it along. But the success of the, you know, the '93 Act and the '96 Act and -- has been tremendous, you know, it really has been a sea change in the market.

And then on the flip site of this the other point I wanted to make was, you know, we keep moving this in what is broadband. So not that long ago I think we said it was 4/1, I think it was, or maybe it was 10/1, and then it became 25/3. And as we're moving that along, obviously from a regulatory perspective there's sort of a, you know, keep moving the carrot so people catch up with it. And then when you dedicate USF money to help -- sorry -- to help -- don't tell them I took that off, I don't want to get in trouble -- when you dedicate -- when you dedicate USF money, you of course incent them very directly to do that. But when you look at, you know, the wireless industry, the numbers that we're talking about and, you know, admittedly data capacity being constrained by a lot of factors that are difficult to overcome. But the numbers are astounding. So we're talking about ten times the number of devices that you can operate at a single cell site today, ten times more tomorrow. So the example I heard was 2,000 devices within one square kilometer. Which obviously in this environment wouldn't make a dent at all, but just in, you know, whatever the test case was for that. Twenty thousand devices within one square kilometer at 5G. And the speeds are one hundred times today. So you're actually looking at one gig being the standard speed in a 5G environment.

Having said that, I read an article this morning that Verizon announced that it had tested multiple gig 5G technologies using today's available equipment. So you're talking about multiple-in, multiple-out antennas, you're talking about beam forming and a lot of really, really, really boring engineering stuff. But the exciting thing is that the private market's solving this problem. We want as many of those customers to give us -- you know, to buy our service and to use us as, you know, their sole provider. And to the extent that there's multiple, you know, modalities being the common approach today, obviously if that continues to be the case, great. But I think that as you look at the market trying to catch up and take more of the -- take more of the consumer spending, it is catching up, and it's catching up by leaps and bounds. Once we get to 5G, hopefully with enough spectrum it will really be a big game changer and answer your question in a very different way than I think we might be answering it today.

MS. CRAWFORD: Just to pile on too, imagine a marketplace with multiple providers selling 5G. That's only possible with fiber, deep in the neighborhoods, deep in the business districts. So these two stories fit together. Open access fiber.

MS. LERNER: But again, you know, my concern is for the ultimate consumer, who has no bargaining power in this marketplace with many competitors who basically set identical terms. Force arbitration, have lengthy contracts which are available. One will adopt a clever idea which gets more money out of the consumer, and surprisingly all of the others think it's a great idea and pile on. So there's no counterbalance. And it's the PSC that should be the counterbalance in the wireless marketplace.

DR. MAYO: But Susan, if I could, just to jump in, just to actually return to the question that was originally asked, which is whether wireless and wire line are substitutes or complements. Just, there is an economic framework for thinking about this. It's looking at the -- at the responsiveness of consumption of one product to changes in price of the other product. And I will say that that study, those studies haven't been done yet. So I don't think it's possible, based on a discussion of simply the technical characteristics of a particular type of service, whether that's wire line or wireless, to declare that they are or are not substitutes for broadband services.

We know, we do know that, as an empirical matter, on voice services, wireless and wire line have become substitutes. And it's not just my opinion. In the last year there have been three peer reviewed econometric studies documenting this. So it can happen. Whether it's going to happen in broadband or not, the jury is still out on that I think. We know that.

But one thing that we do know is that wireless and wire line have different characteristics. One has a superior through-put, but the other has the superior attribute of ubiquity. And the real answer to the question is not going to be answered by a consumer advocate or an academic or an investment analyst, but by consumers, by looking at the behavior of consumers and whether they value that ubiquity more than they value the through-put. And both of those are, by the way, changing very, very rapidly. Which is all sort of I think interesting, but it brings us to the question of what can the Public Service Commission possibly do about this. And the thing that you I think are interested in is providing a set of positive economic metrics to consumers of New York on, for instance, price, output, investment, quality and so on. And there I think you do have it in your interest to see that as many of these technologies compete head up with each other as is possible. So there is a reason why we should be interested in this.

Which then asks the question, okay, what can we do as policy makers, what could we do as policy makers to help that process along. And I think the answer there is one that's maybe not so much in your control, and then some that are in your control.

The one that's less in your control is availability of spectrum. And there's a wide chorus of people around the country that have thought about this for a long, long time. If you've got the demand for wireless services exploding and you don't have the availability of spectrum, a necessary input to wireless services expanding at a proportional rate, it's going to put upper pressure on wireless services and retard deployment, retard the ability of that substitutability for service. So that probably is in the control of federal agencies, NTIA, FCC and so on.

There are some things that you might think about, and I don't know -- have the granular details, but as things like 5G come along, with new network investments that will be necessary at the local level, at the very local level, there are things that perhaps you can do, as a Public Service Commission here in New York, to either to facilitate, to grease the skids, to enable those investments in the fastest possible manner possible. And that would be a very positive development I think as it comes forward.

MR. MOFFETT: I think from the

perspective of the investment community, and I know we're spending a lot of time on this question, but I think it's warranted because it is probably the most important question, which is, is there a point at which wireless and wire line networks emerge as true substitutes. I think it's fair to say that they are not today. That, for the reasons that Susan outlined, both Susans outlined, the cost simply isn't competitive for a customer to try to swap out that level of usage.

From what we've seen so far of what are admittedly somewhat provisional specifications of 5G that Ben was talking about, and that the vendor community have been talking about now for some time, and also millimeter wave that was mentioned earlier, which is a somewhat different wireless technology, both technologies have better than a reasonably good chance of being true substitutes. In fact, from where we stand today, it looks quite likely that they will become meaningful substitutes for the first time. And from a policy perspective that is an extraordinary change, because the challenge with wire line networks is always that the fixed cost of entry in a wire line network is so large, and the return on what is -- the available returns for a second player in the market to build one are typically so poor that it is very rare to find the circumstance for two competing wire line networks to be economically viable.

Wireless networks, while they're still in the broad spectrum of, if you'll forgive the pun, of businesses largely fixed and low variable cost, are nowhere near as fixed and nowhere near as, therefore, low variable cost, as wire line networks are. The capital investment in wireless networks behaves more like a variable cost. And therefore it is much easier to imagine the kind of incremental expansion of wireless networks into competition with each other and with wire line networks without that same incredibly high hurdle that never seems to get crossed with a second wire line network.

So that's an elaborate way of

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saying I think this problem may actually take care of itself to a great extent.

AUDIENCE MEMBER: What about the cost of spectrum? What about the cost of spectrum?

MR. MOFFETT: Well, it depends. If we're talking about reasonably high frequency spectrum, the answer is, you know, millimeter wave spectrum right now is extraordinarily inexpensive. And it's partly because there is so much of it. And I suspect that will probably continue to be the case. Certainly relative to the low frequency spectrum bands, or what today passes as mid band spectrum.

Even in 5G we're talking about different spectrum bands for the standards setting organizations than what we are using today, and they are expected to be quite a bit less expensive, because again, the bands are quite a bit larger and they're much less contested for with government agencies and military and what have you.

MS. CRAWFORD: I just want to make sure there's no confusion here as we talk about these two technologies. To say wireless is going to be great, we're going to substitute for wire line, is like saying who needs airports, we've got airplanes, right, because that wireless, all that data, that tsunami of data has to go somewhere, and that requires a wire line network deep into every neighborhood.

MR. MOFFETT: Yeah. And that's actually very interesting. So if you think about what is the natural end game of a wireless network. Well, as Ben said, the CTIA would tell you that where the investment is going is densification, right, which is smaller and smaller radii of cell sites. Well, what's the logical end game of densification, it's smaller and smaller cell sites with wires running to each one until eventually you have a wire running to every house with a WiFi network again. Well, that's what we have today in the cable network. And so eventually cable networks and wireless networks will actually look an awful lot like each other, and they will become much more competitive. So in some ways it is a simple juristic for saying here's why they will actually turn out to be quite competitive, because the end topology of both networks is largely identical.

MS. CRAWFORD: Or the local monopoly will buy the wireless company.

MR. MOFFETT: Right.

MS. LERNER: And I think, you know, there are certain assumptions and certain statements that have been made. It goes back to the Coalition's desire to have evidentiary proceedings to test the assumptions and assertions that are made. Hopefully they are accurate, but without the data to really test them, I think the PSC is at a disadvantage.

MS. GEDULDIG: So there's been a lot of conversation around investment and outputs. And I think we keep driving back to a little bit of the same point, that there's a lot deployed in one -- in the majority of the state, but there's still those outliers that don't have a lot of cell, they don't have a lot of cable, they don't have a lot of the other wire line technologies because they're remote and difficult to get to. So, which is another aspect of the digital divide. So our next question focuses on that and how has the digital divide changed with the convergence of technology, are there different types of digital divides, is it by socioeconomic, is it by geography, or both. And I'll direct that first to Susan, whichever.

MS. CRAWFORD: You have two Susans.

MS. LERNER: I would say both. I think there are socioeconomic divides for certain. And there are also geographic divides. Sometimes they feed into each other. Certainly in urban areas they tend to be, but not exclusively, socioeconomic. And certainly when we get into the more rural areas of the state, entire areas of counties that have to rely on cellular satellite services for Internet, at great cost. So it's hard to separate the two sometimes.

MS. CRAWFORD: A new 21st century version of the digital divide is between communities that care about having advanced networks that are free and cheap and communities that don't. Not free but available and cheap. Because where -- there's so much capital lowing around, there's a lot money. What we need is financing for a 21st century network, which, as many hundreds of communities across the United States are deciding, has to be fiber. And you will make money until the sun explodes on the gradual payments that come out of a fiber network that will make it worth it to you, if you're patient, to put in the money to build it. So this is Craig's problem, the second comer has no incentive. Well, there are people with different incentives, and sometimes the community has the incentive to ensure that it has a terrific network that is not captive to any of the existing uncompetitive players.

So that new digital divide is coming up in sharp relief. There are a number of cities and hamlets and, you know, unincorporated areas in New York State that are -- that are fed up with the current situation and are making plans to finance the building of 21st century fiber networks.

What the Commission could do is advise the Governor to set up local infrastructure banks or a system of state guarantees for loans to actors who are interested in serving a community with a well-defined plan to put in this kind of open access facility that would drive down costs as retail actors competed across dark fiber to provide services to residences and businesses, that would be infinitely scalable, and would not have to be replaced five years from now. We think that fiber has an effective life of 40 to 50 years. And if -- without tearing it out of the streets you can upgrade it just by installing new electronics. So if you're looking for places to place that, that new digital divide could be addressed by helping communities make these plans and by providing loan guarantees or facilities that lower the cost of capital.

COMMR. SAYER: Should the Commission directly subsidize that kind of endeavor through some kind of universal service funding with a charge on telephony subscribers, cellular subscribers, broadband subscribers, or should this be left more to the economic development agencies?

MS. CRAWFORD: That's an interesting question and not one that I've pondered deeply enough to answer. It seems to me that there is enough capital out there anxious to do this. Anxious for those long term until the sun explodes returns that you might not have to set up a universal service fund to do it. Just guarantee the financing so it's at a lower rate. There are sovereigns in other countries that might want to do that. There are international pension funds. God knows who might like to be involved in this. But without low cost financing, they're not going to get into it.

MS. LERNER: So I obviously feel that the universal fund could be helpful. But I'm also concerned that we're losing sight of an actual real world experience that we have here in New York in terms of relying upon private industry to build out the fiber network. And that is our experience with Verizon FiOS, which has been very much of a mixed bag. Promises made and then not kept. An ongoing dispute here in New York City between Verizon and the city as to the efficacy of the build-out. And certainly we at Common Cause have been hosting public forums and we have gotten an earful from a lot of very angry people about the difficulties of actually obtaining FiOS here in the city, where there should be really significant build-out, with the idea of having competition.

So relying simply on public industry to catch up because, you know, there are incentives to do so, our experience is that the incentives are selected in terms of geographic region and don't seem to carry through in the long run if there's any kind of corporate leadership change or if, you know, decisions made from a corporate point of view are different. Corporations have a different goal than what we believe the Public Service Commission should have, which is universal,

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reliable, reasonably affordable service of all kinds of telecommunication.

So, you know, I find the discussion interesting, but when we look at the private marketplace, we see some real gaps in performance.

MS. ZIBELMAN: Jeffrey.

MR. NORDHAUS: Thanks. Just to address on the point about the New NY Broadband program, first of all, I'd like to clarify something. The New NY Broadband program is not just for incumbents. It's for anyone. If you're a community and you want to serve your community, it's unserved, you can bid. It's an auction. Whoever -- I see the light's going on. No, go ahead.

MS. CRAWFORD: As long as you're not within the Time Warner cable franchise areas or in any CAF area.

MR. NORDHAUS: Right, okay.

MS. LERNER: So if you have the --

MS. CRAWFORD: -- basically any --

(Cross talk)

MS. LERNER: -- financial

wherewithal that basically seems to be written for the larger companies.

MR. NORDHAUS: Okay. Well, let's address both of those points, because I think it's very fruitful to have the conversation, just to at least make sure we are clear on what's in the guidelines, and then we can debate whether they're the right guidelines or the wrong guidelines, but at least we can level sentences of what's in the guidelines.

So, first of all, what's in the guidelines is any unserved area of New York, except the two exclusions that you mentioned, and let's come back to those in a moment -- no, no, no, I'd like to talk about those in a second. So the unserved communities that are -- there are a number of unserved communities that are still unserved even after Time Warner Cable is making the changes, assuming the merger goes through on the federal level and the order is implemented, then let's just briefly touch on what those changes are. So, at a high level, anyone in the -- anyone -- mostly downstate is 300 megabits, I believe, and upstate is 50. All the areas that are 50 upstate will go to 100 by 2018, and will go to 300 megabits by 2019. And that's covering in excess of I think two million housing units. So it's a pretty dramatic, you know, upgrade.

But then there's folks who have nothing. Some of them are in the Time Warner Cable franchise areas, which have not been developed -- and I defer to the PSC, by the way, because I'm not a representative of the PSC and I don't know this intimately, but this is just my sort of work-a-day understanding of it -- is an additional 145,000 homes will be built out. Those are people who have no service, at least no service at 25 megabits or potentially higher. But the vast majority of those are in areas that have no service. So the question that I would have is do -- does it make sense to have a program, give funding to an area that already has service, so, in other words, to fund a second entrant, versus a community that has no service at all.

MS. LERNER: So that --

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MR. NORDHAUS: So that -- yeah, no.

MS. LERNER: -- you're talking the infill versus, you know, the lack of service entirely. You know, I'm not really in a position to channel Mayor Stephanie Miner from Syracuse. But certainly I think Syracuse is an excellent example of a area which is shown as having broadband service on the broadband map within the Time Warner service area, and yet the city finds it necessary to try and figure out how to build out their own service in a significant part of their footprint because, as the mayor has said repeatedly, Time Warner has indicated that they are not going to build out to the neighborhoods that are not served. And this is an ongoing concern.

MS. ZIBELMAN: I think that that is exactly the condition that we have put into the -- that would get built out. But I think that's a good point, which is, the digital divide issue sort of is -- it's a socioeconomic issue. We need to make sure that everybody has affordable services of whatever we decide are the essential services.

Then there's the geographic issue. And in my mind the geographic issue is markets and sub-markets. And that's one of the issues that we sought to address, frankly, in the merger, which, as we saw, the sub-markets were Albany, Syracuse, where they would have access to high speed broadband in the suburbs but not in the inner core. So I think we need -- I think we can all agree that there ought to be no divide rather -- either geographically or economically, and that's what we're looking to address.

My question I guess is around that, getting back -- I know it is about people, but it's also about investment. If we're not going to go back to regulation, that you are going to have a situation in all likelihood in some markets, unless we move -- go to the dark fiber route, where there is to be a monopoly or duopoly, because there's just, unlike downstate where we see lots of competition, we're not going to see it. And should we be thinking in terms of state regulation that there's -- just like the markets are not, you know, they're not homogenous, nor should regulation be homogeneous, because there's very different market needs when you're in New York City versus in rural New York, and we ought to be sensitive to that.

MS. LERNER: Although I've been surprised to hear very similar complaints in suburban Albany and in parts of New York City. People who feel that they cannot get adequate service at an affordable price, or that they are one block away from being able to get broadband service. And you find that in Queens and you find that in towns in the suburbs of Albany.

MS. CRAWFORD: Just to speak to the rural issue. I hesitate to bring this up, but in Sweden, there are hundreds of little, tiny towns that lease dark fiber, that make -- because state funding was contingent on creating dark fiber, they -- that's what they did. And then that creates a competitive marketplace even in the very smallest spaces. So it is possible. And there are investment banks, like McQuary seems to want to come into Connecticut to build a whole lot of dark fiber between Connecticut towns and in those towns, because it knows it's going to make money. The town will own the fiber, McQuary will build it.

MR. YAKEL: So maybe I can try and bring this full circle again. You know, we're talking about advanced networks here and where they are and where they're not. And again, a couple of the observations is when we look at New York State and we look at the multiple platforms that are available to consumers today, the landscape is very, very different than it was a decade ago. Cable companies were only doing video, they were one way systems. They spent all this convergence, they're now into the phone business and the broadband business. Things are reversing for the telephone industry as well. They're losing phone subscription, but companies like Verizon that have deployed FTV networks and some of the smaller CLECs that Bob Puckett talked about earlier this evening are now getting into somebody else's business. What we're seeing is that there's multiple companies that are filling multiple roles, whether it's a niche market or it's a mainstream market. And we're talking about getting to those gap areas. We're recognizing that there's a lot more providers that are in this sphere today than there were before. And even to the point of the middle mile, I think we're seeing that the market is opening -- opening up, and where there's a need in the BPO programs is touching on that as well. But we're not fixated on a single mode, a single type of infrastructure, because we're recognizing that these services are now being provided over more than just the copper landline network. They've moved over to cable networks, terrestrial wireless, fixed wireless, and satellite systems. And I think -- we've talked about this in the first panel and the second panel, and I think we are tying a lot of these things together, to the end result of how do we get it to the last mile, the last home, and filling in those remaining gaps of the few percent of New Yorkers.

MS. GEDULDIG: Any takers?

DR. MAYO: That was an uncomfortable pause. I'm responding largely for the same reason my students nervously will speak up after I ask a tough question. They just don't like the quiet.

I think you're right. There is, and again, not everybody on the panel is going to share this opinion, and it's a discussion worth having, but New York I think has seen a growth in the cross-section of broadband provision. It's seen a growth in the dynamic over time in the provision of broadband. You've seen wireless and wire line and satellite providers that are headed toward each other in terms of competition, and we can quibble about how much competitive pressure they put on each other, but I think we know that they're headed that direction. And I understand and I am sympathetic to the idea that we need to be as gracious and generous as we possibly can to the folks that we just were talking about, the digital divide folks that, say, whether it's by income or geography, you ought to have the right to participate fully in society's rich benefits. No argument there at all. The question is how do we accomplish that goal in the most economically efficient manner possible. Do we do it through government mandate? Do we do it through incentive based schemes? And that's what you're really wrestling with here.

The I think good news is that you've struck on, from my perspective as a bit of an outsider here, but I've been studying the industry for 30 years, you've struck on a really quite nice balance in New York, and that is that you've created a light touch regulatory approach dating back to let's call it to 2006, but there's a much longer lineage headed that way before then, that said we're going to largely be consistent with the National Telecommunications Act, which is to promote a pro-competitive, deregulatory environment. We are going to see how it goes, we are going to be mindful, we are going to watch how it goes, we are going to look at the results. I think it's worth looking at the results, you ought not to look the other way, you ought not to be asleep at the switch. But where it's working, you have the opportunity to rely more on incentive based mechanisms and less on regulatory fiat. It's -- I think you're headed in the right direction on this.

MS. CRAWFORD: Well, if I could just respond to that, I mean, what we've seen in New York since deregulation is playing out of what we already know to be true. Where consolidation and market division is possible, competition is impossible. And that's what's happened here. So Verizon is now squeezing its copper, not updating to FiOS in most of the state. Frontier, also squeezing copper. Cable hanging onto its franchise areas. The phone companies are, and specifically Verizon, really backing off and becoming much more of a wireless company than a wired one. So they're easily dividing markets, that's what's happened. And as a result you have exhibitant pricing in New York State, and not a whole lot of new, you know, network infrastructure coming in that will survive into the next 15 or 20 years. That's your problem.

What do you do? And there's several steps you could take that would be regulatory in nature that would encourage the growth of genuine, ubiquitous, cheap wired fiber networks. It really does have to be fiber. I know there's a lot of talk about technology agnostic. Don't listen to that, because you will end up with something that then has to be ripped out and upgraded again in a few years.

So things you could do would be to encourage things like statewide franchising, that seems like an easy one, that would allow those providers who feel they need to sell video content as well to not be a substitute to hold onto investment in town. You could allow people to sell high speed Internet access without -- and get access to poles without being labeled as CLECs. That might be useful. I understand that companies are ignoring the pole attachment order and there's a whole lot of delay. There are things the PSC to do there to enforce that order. That would be good.

This planning function for cities I think could be -- could be revolutionary, if there's even a small grant program, however funded, to help all these hamlets get their act together and figure out how to attract private capital into their dark fiber networks. That would be extremely useful.

Setting a very high standard for the state as to what constitutes acceptable 21st century connectivity would also be welcome.

MS. LERNER: You know, I must say that I am struck by the fact that this is not the first time that our country has had to deal with these issues. We've dealt with them on rural electrification, we've dealt with them in universal telephone service, and I think we are dealing with exactly the same issues in broadband. And in both of those earlier instances there was a point at which the government had to step in and ensure that there was service in the last mile. And I think we are very close to that point here in New York State.

MR. ARON: So if I could respond first to Commissioner Sayer's question a minute ago. Just a word of caution, and that is, right now in New York State the rate on consumer bills for taxes, fees and surcharges is 24.4 percent. So my word of caution is adding to that already, use a politically correct word, fairly high number --

COMMR. SAYER: Ridiculously high.

MR. ARON: Yeah.

MS. LERNER: And we have questions about where does it actually go.

MR. ARON: So the word of caution would be not not to do it, but to consider the source of the revenue for it might be prudent.

And to respond a little bit to Susan, I actually had a conversation with an engineer about the relative benefits of microwave versus fiber recently. And much to my surprise, you know, part of the discussion was that there are many instances wherein a network microwave is a viable substitute, in some instances a better substitute. With direct line-of-sight it tends to be faster than fiber.

But, you know, leaving that aside, I think that to the extent that you're looking at how to get to the last mile, I think that all sources should be considered. But recognize I think primarily the CAF money is still being spent, and examine how that goes before investing more and potentially double dipping, so to speak, in certain areas. And you want to avoid that and make sure those public funds are spent well.

You want to look at the extremely high cost area, which is in 2018, so somewhere in the nature of two years off now, the FCC is going to examine that and dedicate some, you know -- I don't know that they've defined what they're going to do, but they're going to examine it, and the assumption of course would be that they take some action.

So some of those areas that today are difficult to serve, you know, those last mile areas that you were talking about, Susan, the hope is that some of that gets covered by that federal funding. So part of it I think the story is patience and allowing that money to get out there. And then deciding where is it that it didn't get to, either at all, right, and is that a problem to fix, or where did it get to inadequately and is that a problem to fix.

But as we sit at the cusp of all of that spending, you know, the word of caution at the front end is, you know, to let it work its way into those areas and see what effect it has first. And don't raise the 24.4 percent.

COMMR. SAYER: I'd like to ask the panel if any of you would add or subtract from the areas of state commission action that have been suggested so far, listed very well by Professor Crawford, statewide franchising for video, pole attachment streamlining, helping the planning function of municipalities, having a high standard for state broadband funding. I think we'd probably want to add on the affordability side some kind of universal service funding for low income broadband customers. What would you all add or subtract?

MR. ARON: I think from our perspective we would add state right-of-ways. The areas that were discussed earlier that are difficult to serve, I know the Catskill Park, Adirondack Park were discussed. And one of the primary reasons that there's challenges for service there is getting the state right-of-ways is not easy. So, you know, that process needs to be fixed. A statewide streamlined process to zoning would be great so that it's not a new and different fight every time we go and try to locate in a new city or municipality. And those need to be fixed.

And I think from our perspective, as we look at the next generation of networks that, you know, the pole attachments and the right-of-ways are going to be the most important. And we really can't stress enough the importance of a known, knowable and defined time line, reasonable rates, terms and conditions, pole top access, and access to the Commission in instances where the market is failing to work as it should. You know, absolutely essential to get 5G rolled out to have that.

MS. CRAWFORD: Another area could be where the FCC has been digging into the special access marketplace, or backhaul, some of the commentators to the RFI for the new broadband plan said that they couldn't get access on a reasonable price to backhaul. So no matter how well they were doing in their communities building networks, they couldn't get out, there was no competitive market to get out. And that seems like an area that could be examined.

All of this depends on a much more robust data gathering function. And publication of price data as well. Because right now we are all operating in the dark a bit. We don't really know what's going on.

MS. LERNER: That's where I was going to go, which is that we really need to

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have an understanding of what service is actually provided on much more granular level, and how can we determine where there is competition when we don't really accurately know where broadband is actually being provided to the consumers. The data is just not sufficiently detailed. And that's why, you know, we have been asking for some sort of an evidentiary proceeding, but certainly the PSC getting to a more granular level on the broadband service map I think is essential to make any reasonable determinations of what to do.

MS. HELMER: I would just tweak one of -- actually a couple of your suggestions, Commissioner. You know, statewide franchising is a tough nut politically. But there is a value I think to the Commission providing assistance in those situations where there is a difficulty, whether it's a municipality, whether it's a government agency that's suddenly imposing a new fee on its right-of-ways and so forth. There used to be a municipal assistance group within the Public

Service Commission that would work with municipalities as kind of an honest broker and address some of those issues before they went to full bloom litigation or spent two years, you know, with parties arguing with each other and then, you know, eventually abandoning a project. So I think that's important.

And also, IP to IP interconnection is something that, you know, folks had started to talk about at the FCC and among the states, and an issue I think that's worth having a conversation about.

MS. LERNER: One thing I forgot to mention is we would like to see the Commission take a look at the actual billing practices of the companies for broadband and for cable, as well for phone.

MS. HELMER: My concern, you know, needless to say, anything that resembles price regulation is a real issue for competitors. You know, the reason we are sitting in this room and having a conversation about a very, very small portion of or percentage of the consumers in the state is because of the fact that, and this has been mentioned by several of the panelists, the fact that there was a regulatory environment for -- and it's not a long period of time, you know. A lot of investment was made over a very short period of time because there was the regulatory environment to make that investment. And so now we're talking about the nubs, we are talking about the tough pieces, the places that are hard to get to, the places that are, you know, the last mile in the middle of the Adirondacks and so forth and having to deal with the Adirondack Park Agency and the Department of Environmental Conservation and all of these issues. And maybe they deserve some special attention. And I think the broadband offices and the Governor's program are doing a very, very commendable job of trying to address those issues. But don't forget the fact that the reason we're sitting here now talking about four percent of the state instead of 94 percent of the state is because of private investment.

MS. LERNER: And again, we contest

that figure because our experience is that virtually every single place on the map which shows a hundred percent coverage has some gaps, and sometimes significant ones.

The reason I talked about billing is that the consumer is experiencing all kinds of mystery fees on the bill. We don't know where they go. There have been assertions that in some cases there are FCC fees which have sunsetted that are still on consumer bills. And this is a pretty terrific way to build in additional profit without it being obvious to the consumer.

Again, the consumer has no bargaining power here. You get a bill, it says there's now going to be a two percent fee for whatever. They turn it over or else they lose their service. And we don't actually have any indication where those fees are going, if they are actually legitimate fees, and if they're being turned over to the state government or the federal government. I think that's a reasonable inquiry.

MR. ARON: And I might make the

observation in retort that one way to take care of the mystery fees is to take all of them off the bill entirely, right, and to just collect from the general fund. Because the true amount of the bill is what we charge. And everything else that gets added on, and it's complicated, right, there are charges after charges, there are, you know, local, there's municipal, it gets into the tax rate for the location where the, you know, the collection is made and, you know, and so on. It's really complicated. And you add in the federal and the local and the state. Get it off the bill. You know, let consumers pay the actual service charge and nothing but that, and then have everything else taken out of the general fund to fund it. And, you know, problem solved, no mystery charges.

MS. CRAWFORD: I just want to make clear that you're not just talking about four percent of New York State. This is an obligation to the entire state, because the deregulation -- the regime we've had for the last ten years has led to a situation in which for most of the state there's almost no choice, right. So we thought competition would protect consumers. It has failed, the market has failed to provide competition. So now our obligation, your obligation is to think through what steps to take to make sure that everybody has not just terrible connection but a connection that can rival any place in the world. That's your obligation.

MS. LERNER: Terrible connection at high price.

MS. CRAWFORD: Yeah, right.

MR. NORDHAUS: So I'll just add from the broadband perspective that we agree with regard to the map. In fact, I was with the FCC recently, and one of the biggest challenges we've had in trying to identify, and you mentioned this, a couple of examples, to identify where there are unserved folks is the lack of data. When you are dealing with a 477 filing that is a one served, all served by census blocks, that just doesn't work.

We share the goal, we want to get to everybody. And so the current phase that we have, I would like to just highlight, is a phase one. So to get to the unserved, and then if there are more, even in the pockets within served communities, or perhaps Time Warner areas that aren't being dealt with, whatever it is, those will be phase two, phase three. I mean, this is just sort of the beginning.

But to your point, I think vis-a-vis the broadband map, that's a very important point. And we've tried in the past to get address level data, and that hasn't been something that we've been successful. But we think folks should continue to push for that at our level, meaning, you know, state, local, and at the federal level with the FCC, because they're ultimately the ones that are asking. They have the authority, and I'm not a legal expert on it, but they have the authority to ask for that, and could potentially get it in more detail. And it would certainly help us identify any of those pockets that are out there that we need to still get to.

MS. LERNER: But I think PSC could also require that information.

MS. ZIBELMAN: So just to, while we are on this point, because I would like to hear from everyone, because it's just useful for us to understand, if we could stay on this list, of what things the Commission could be looking at doing. There maybe things that the Commission or the state can do that the Commission can't do on its own. And then maybe there are things that you can suggest that we can advocate for at the FCC level as a regulatory body. But it would be great to -- if we can get your insights on what we should be thinking about, what we can do to help things along.

DR. MAYO: So without sort of endorsing the earlier sort of laundry list of things that you can do, let me just mention a couple that I think.

One is, and this is an interesting challenge for you, because competitive markets work best when consumers have information, right, and they know what they're buying and what the quality of the good is and what the prices are. And here we have a market that is so dynamic that it is challenging. I think we would all agree it's challenging for consumers to keep up with what it is that they are buying and what the quality is and what they can actually do with the services that they buy. So one of the things that I think might be a very useful role, and it doesn't have to be any heavy handed approach I think, is to think about policies that can be enacted that promote information for consumers on how to make those choices. I'd like to know what I can do with 12 megabits download as opposed to 15 or 20. I think a lot of consumers would like that information. I think that's -- and again, I'm saying that's a pleasant problem to have because the market has been so dynamic. And so that's one thing.

Other things that I would harken back to is to say that anything you can do that would ease the ability of any firm to expand its output, to expand it through investment and so on, any policies that you have that implicitly or explicitly restrict the ability of firms to chase consumers, by way of saying no, you shall invest in this technology, whether that technology is copper or fiber or wireless, those ought not to be your choices. Those ought to be -- there's a high powered incentive, as I said, people lose their jobs if they get the incentive, if they don't do the investments right here. That the firms actually have high powered incentives to get this right. Now, they're not going to get it right all the time. They're going to make some bone-headed investments sometimes, and fail to make some investments they should. But they have high powered incentives to do it. But my point is to try to remove any policies that you have that create through regulatory dicta what you shall invest in, the specific investments.

And then finally, to the point that was mentioned earlier is, I think it has been a real positive development that you've moved in this state away from rate based rate of return in regulation, and moved away from --

because that has distortionary effects we know on investment, and it has -- it dampens, it dampens or distorts, let me put it that way, it distorts investments.

But -- but, I think that what you might do is be at this juncture more explicit about eliminating the prospect of profit regulation, of any profit regulation. Because the threat of profit regulation itself is going to -- is going to alter the marketplace in an undesirable way. There's rich, robust economic literature that suggests that, indicates that, not suggests.

MS. CRAWFORD: To add to the list with some really regulatory ones, I'm a New Yorker now but I grew up in Santa Monica. And they have a terrific fiber network because the chief information officer was present at every meeting where the streets were going to be ripped up. They had a dig once policy in Santa Monica. They had to think about fiber for any public project. If there was a statewide dig once, think about infrastructure, communications infrastructure and specifically fiber every time the streets are taken up, that would really help. That would make sure that incrementally these bills are happening.

Another one you can borrow from the state of Connecticut, they have a single pole administrator. A mystical achievement. I'm not sure how they did it, but they did it. And that means that there's one entity you go to, there's a shot clock, there's no fooling around, it just happens. There's a data base, you know how to find out about poles.

And the third one, which I mentioned in passing earlier, I just want to make sure is on your list, is the idea of loan guarantees, which pay off and there's spillover effects enormously. But if you put aside a very small amount of capital or persuade the Governor to do so, you will attract enormous private investment into these dark fiber networks.

MS. LERNER: Suffice it to say that we're uncomfortable with allowing only an economic analysis to drive the Commission's determinations.

MS. GEDULDIG: So along those lines, I think we all agree that the Commission has a very significant interest in consumer protection. So what on the consumer's side, I think John talked about education and information to be shared with consumers about exactly what the services that they're using are and what they mean, what they can do. What other items can the Commission consider or should the Department recommend along with consumer protection?

MS. LERNER: Well, I think standardization and simplification of billing practices is a very pro consumer approach. Right now the bills are very confusing, and not just in the tax area but with all sorts of arbitrary fees which are created.

I think looking at the contracts, which are not negotiated but rather imposed by the companies. And, as I think I said it earlier, the pro company, anti-consumer provisions tend to be identical between the different providers. So that if you don't

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want to sign a contract for a arbitration provision but you need cellular phone service for whatever reason, you don't have an alternative. The competitive marketplace is not working that way.

So there are, you know, contracts of adhesion really in these marketplaces where the consumer has no bargaining power. And it really should be up to the PSC to be looking at some of these provisions and coming to a rational decision of whether the consumers should have an option to opt out on some of these things or some ability to give the consumers some bargaining power.

MS. CRAWFORD: The potential role to protect consumers and one the FCC really can't carry out is to be the place where consumers' complaints go in a very active way. I see some disagreement from my colleague over there, but that doesn't exist, and that would be useful.

We have an adoption issue in New York State. A lot of it may have to do with price. But New York State has the lowest rate of adoption, for even these 25 megabit services, than any other northeastern state, any other northeastern state except for Maine, and Maine is like the 38th densest state and New York is the seventh. So it's not density that explains it. It's something else going on. It might be price.

There may be more that could be done on, you know, the telemedicine front, the education front. Modeling services that are going to be useful for consumers and helping them understand how relevant this is to their lives.

MS. LERNER: Certainly consumers' education is excellent, but the reason why I grimaced was, unfortunately, what we're hearing from our people is that the complaint process with the PSC is not satisfying the consumers.

MS. CRAWFORD: Well, that they can fix.

MS. GEDULDIG: So we also for today's panel heard a lot about outputs and the importance of them from a service and a quality standpoint. So I'm curious, we can start with the industry panelists, what kind of service metrics do you look at and what are you measuring to ensure that not only is your service reliable, but that you're driving it to be better.

MS. HELMER: How many customers we have. I mean, it's as simple as that. If someone is not satisfied with the contract, they have alternatives. They have wireless alternatives, they have satellite alternatives, they have Direct Dish alternatives, depending on which particular service or services you're talking about. Their service has to be reliable and there has to be good customer service or they are not -- the customers are not going to stay.

Someone mentioned earlier that a lot of money has gone into things like set tops. It's also gone into things like how we respond to customers, and the mechanics in terms of scheduling truck rolls or whether it's answering telephones or whether it is the kind of information you can get from the

Internet.

A lot of the old kind of service quality measures are just becoming more and more arcane. You know, how many seconds you wait on the telephone. The younger demographic doesn't go to the telephone to get a problem solved. If they've got a problem with their product, they get online, they go to a chat room. They get online with the website for the product, where there's a set of frequently asked questions. They're not sitting on the telephone waiting for, you know, some person in, you know, wherever to answer the phone and answer their questions. It's evolving. Are there still people calling? Sure. But, you know, to the extent that there are service quality measures for any of these services, and there still are for some, you know, I think we need to re-look at whether or not they're measuring the right things. But in terms of areas that are competitive, such as cable service and video service and broadband telephone service, people have the ability to switch, and that is the ultimate customer service indicia.

COMMR. SAYER: So Maureen, don't cable companies have internal operational metrics that they hold their local managers to --

MS. HELMER: Sure.

COMMR. SAYER: -- to make sure that they're performing?

MS. HELMER: Sure.

COMMR. SAYER: What are the kinds of things that they measure internally?

MS. HELMER: I think that's something that we would have to have a more confidential conversation about. That's really -- I would consider that trade secret and I wouldn't consider it uniform across the companies.

MR. ARON: So for wireless I think, you know, similarly, you know, how each company measures might differ. But at a top level, consumer satisfaction, they're measuring C-sat. The FCC data shows that there's 56 wireless complaints per one million customers in 2014. So it's just tiny numbers with a lot of zeros after a period. And that's good. The carriers obviously work hard to keep those numbers low. They measure churn. So how many of your customers are leaving you for your competitors. The lower that number is, obviously the better. And you'd exec -- expect, rather, customer satisfaction to be similarly high when the churn number is low.

Performance of the actual network, they're measuring data speeds, they're measuring performance at sites, they're measuring it in cities, they're measuring it in counties and regions and states. The metrics that they measure to try to make sure that they have their finger on exactly how their systems perform and performed in relation to their competitors is considerable. A lot of time spent on that.

They also pay attention to independent testing organizations. So your J.D. Powers, your Consumer Reports, your root metrics. They measure all manner of performance metrics, and they report on it

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independently. And how those reports come out is impactful to the carriers and they pay a lot of attention to it.

We, as the industry association, we've tried to help them, you know, spearhead some initiatives. So the CTIA code would be an example that incorporates a lot of consumer protections and is recertified to annually by the companies, is a good example.

I know that, you know, overages, you know, my teenager son or daughter send out 50,000 texts in a month and I got a hundred thousand dollar bill. We responded to that when the governments reached out to, you know, us, the public service commissions, the AG's offices, and we voluntarily agreed to produce notification of outages.

So I think there's a dynamic, you know, there's a dynamic process between the government and the industry in which we try to respond to what we're hearing, and hopefully stay a little bit ahead of the game. So we're looking at, we've issued -- the association has issued location based service guidelines.

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So we're trying to make sure that the give and take between, you know, when you ask your, you know, Google maps or Waze or whatever for directions when you're driving, you know, there's a give and take regarding how much data they're pulling off of you and how much you're, you know, you're using from them. So we have privacy policies. We have location based service guidelines, the notification of outages. We have app content rating guidelines and others.

So what fundamentally we're trying to do is hear everything, right. So the government is looking at privacy, and so are we. We're concerned that we make sure that our customers have a good idea of what -- or at least that they have the ability to obtain the information. And part of the problem is, and I'm guilty of it, do you really read the whole, you know, disclosure or do you click the box so you can get to the next screen quicker. I click the box. But the information's there, and it's incumbent upon people to hopefully understand. But part of that education process is important. And I think, and the Public Service Commission is traditionally a body that does provide some of that education to customers about, you know, what is it that you're certifying to, and how is the interaction between your device and the network or the third party provider, how does that all operate.

So I think it's a -- you know, there's a lot of going on in the space. We have interaction between different state agencies, the attorney generals we mentioned, the Public Service Commission. At the federal level you have the Federal Trade Commission for some issues, the FCC for other issues. So there is so much going on in the space all the time that, you know, we try to hear from the regulated -- the regulator -- the regulatory community what it is you're concerned about, and take, you know, our practices and put them under the magnifying glass and see if there's anything that we can do to make those practices better, both for the consumers, so that when we do measure C-sat and churn and things of that nature, that the numbers are good. And just as a general basis because it's the right thing to do for customers and, you know, to keep them happy and to provide adequate service.

MS. GEDULDIG: So how do you measure customer service? Because we're hearing a little bit about is the connection or is the service good, is it terrible, people are complaining about it. So how do companies measure their customer satisfaction?

MR. ARON: You know, I don't know that, you know, to the point that was just raised, I'm not sure that I know the exact, you know, methodology for it. I'm sure that in part it's, you know, how many complaints received, how many of them are -- I'm trying to remember metrics I've heard in a past life before the association. First call resolution, you know, how long a customer service agent takes, do they call back to have the problem resolved.

I think that a lot of -- and mind you, they're kind of just, you know, brainless standards, right, it's just a did it meet this threshold or that threshold or the other threshold. But at some point, you know, any measurement has some level of just blindness to it, right. There's a threshold and did you cross it, and if you crossed it then you're at whatever the next level is. So there -- I think no matter how they measure it, it's going to have some of those indicia in it, right. Whatever the threshold is, was it met or did they go to the next level and then how many at the next level and so on.

So on the consumer side I think you're looking at more of those somewhat arbitrary, you know, first call resolution, you know, calling back. You're forced to deal with measurements in that regard, because you can't really ask somebody how happy are you, right, I mean, it's subjective. So they're trying to find the objective factors that they can measure discernibly and then, you know, and have that data be meaningful.

And then on the service side I think is where it's, you know, it's easier, right. How fast is my network performing, you know, what are the data speeds on it, what's the text, you know, rate, what's the latency, right.

Actually, just off topic, but I heard this fascinating factor on 5G that I'll share. One of the things we're talking about in terms of data speed for 5G is that the latency goes down. And we released a paper on this, and it's, you know, a picture tells a thousand words. In 4G it takes a car four and a half feet to stop once it's done its sensing and reacts to it. And in 5G that's down to one inch. So things like how is my network performing, you know, those are things that we measure, but they have real life applications to them.

So, you know, on the consumer side, trying to find objective standards that we can measure. And then on the network side, you know, it's just the literal how is it -- how is it doing, how do those metrics match up to expectation, how are they between markets, you know, et cetera. So that hopefully that helps.

MS. GEDULDIG: I have a little bit of a left field question, but we've been talking a lot about it. It comes -- it's on the question of disaster recovery and security. I think this falls squarely within the category of things that customers don't know to ask about or aren't sure about. And I don't -- I'm not asking for details because I don't want anyone to talk about their cybersecurity issues. But is there a place for state regulation or regulatory involvement and policy making in that space?

MS. HELMER: Cybersecurity is one of those areas that I think has had the richest history of public-private cooperation, because government is so intertwined with business on critical infrastructure, and I think it's done a very good job. But there are customers asking about that, especially enterprise customers. They care about resiliency, they care about redundancy within their network and whether or not the redundancy that they have really is redundant.

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We've learned so much from World Trade and from all of the various natural disasters that we've had in terms of where are the networks weak, where are they not redundant and so forth. And I think that the work that the Commission has done with all the utilities, whether they be communications utilities or energy utilities to look at their emergency response plans and the resiliency of their networks has continued to, you know, provide added value to the networks in terms of cooperation.

One of the very -- I really want to give a pat on the back to the Commission about, it was always very difficult in times of emergency for communications companies, and particularly newer communications companies like cable companies, to work with utilities, who were very, very -- have a strong kind of ownership interest in their networks. And the Commission has really stressed with all of the companies that all of these companies have to work together during times of outage, because broadband has become so important, because video and telecommunications services have become so important that, you know, when there is a particular line out, that the companies work together out in the field to be able to address those issues. So I think the Commission has really done a lot to help in terms of the coordination between the companies.

But both cybersecurity and physical resiliency are issues that are very important to customers, but in particular to enterprise customers. Not that they're more important, but they get articulated I think more on a one to one basis.

MS. CRAWFORD: I don't disagree with that characterization of the conversation. There is a lot of talk about cybersecurity and resiliency. But we saw after Superstorm Sandy how inadequate our battery resources were in this city and in many other coastal cities. There's a big gap. The FCC is not really stepping into this with both feet. And the state commission's role I think could be beefed up to set requirements for the resiliency of utility providers. And I would put in that category everybody selling a high speed Internet access connection, you know, that that's now in the bucket of services that has to be brought up, has to be backed up by adequate battery power. Really this is a huge issue, and I'm glad you're thinking about it, because no one seems to be taking hold.

MS. LERNER: And the consumers generally are not really cognizant of the fact of how their various systems interact and that which systems are dependent on their home electrical power and which systems can be relied upon in an emergency.

MR. ARON: So you know, on the -- I'll add to the discussion a few numbers that are fascinating. So the first is one year. And one year is the average time that a government employee trained in cyber as an expert remains with the government. They're quickly gobbled up. It's actually, I forget the number, but they have a negative whatever it is --

MS. CRAWFORD: Sure.

MR. ARON: -- unemployment rate, I mean, they are gone, they are in super, super high demand. And they're going to industry. So, you know, the good story that we have to tell on cyber is that as quickly as they can be trained, whether by us or by others, we are bringing them on and trying to defend networks. So the investment in cyber is active and ongoing.

I don't know that I would agree with the characterization that there's any confusion in the space. There's a lot of work going on in the space. But, you know, from our perspective we've been working with DHS and with the FCC on this and working with them for quite some time to come up with a system that's workable.

There are -- let's see if I can remember this, it's the -- it's one of the worst acronyms ever, the LCCS, I forget, it's the local tribal territorial county, city, something or other, it's the -- there are -- you know, there's that. There's several organizations that are under the umbrella of the Department of Homeland Security, so the National Cybersecurity Incident Center and a few others. There is -- it's a unique space in and of itself, and I'm certainly not an expert on it. But the point is, it's a hugely active space. It's just that it's not huge -- it's not hugely visible, right, because most of the work that goes on is to make sure that nobody knows that anything happened because nothing happens, right. So it's kind of like, you know, an offensive lineman in football, right, if the flag is thrown then he's had a bad game. If you never hear about him, he had a great game. And it's similar with cyber. You just never want to hear that it happened. And that's the primary effort is just to prevent it from happening. So there's a ton going on.

One of the other numbers that's useful there is 56. So 56 states and territories and 56 sets of state Freedom of Information Act to deal with. And one of the problems that we have in cyber is that everything that's discussed is, you know, very, very sensitive, right. If the information gets out, then that's the information usually needed to attack systems. So that's terrible. But the sharing of that information is important to make sure that if one company suffers an attack and it's a certain type of attack, then other companies can become aware that attack happened.

So the sharing of the information is very, very important. But the fact that companies are going to be very, very hard pressed to have 56 different responsibilities and 56 sets of Freedom of Information Act laws makes it very difficult to deal with it at a state by state level. And part of that discussion too is ongoing through the NERUK organization and with some of the states.

So it's a very, very fast developing field. We're, you know, keeping up pace with it, you know, at a functional level in terms of preventing attacks. And we're still defining, you know, even as we speak I think the FCC is days away or weeks away from issuing a policy statement on what its meetings with the carriers will be. And so even as we sit here as state regulators and ask what can we do, you know, the FCC is actually still arranging what it's going to do even as we've been interacting with the Department of Homeland Security for quite some time. So a lot, a lot, a lot going on in the field.

On the network resiliency side, you know, it's an interesting space because there's a give and take with so many different things. So, you know, there's an interdependency between electricity and telecommunications. You know, we are a huge consumer of electricity. And people also really hate having massive diesel tanks sitting anywhere near them, right. And as we densify the network and put out small cells, it's simply impractical to have a generator sitting on a, you know, on a street corner next to the, you know, the walk, don't walk sign.

So there is a lot of effort that

goes on to make sure that we understand the network architecture and that we try to have battery backups, for instance, at every site. And it's the really, really long outages that become problematic. And that fortunately is the really, really small percentage of outages. Most outages are, you know, an hour or two hours. You guys probably know the numbers on those much better than I do.

But the carriers in that space too spend a lot of time trying to find better answers. So I was talking with one of the carriers recently, and they're installing a methane -- methane backup, if I remember, a methane backup battery, which has a different lifetime characteristic, running characteristic, rather, than your traditional, you know, battery cell backup.

Rooftops remain challenging for us. But, you know, just as a for instance, as the state commissioned, natural gas is a great source of alternative, you know, of a -- of generation when you can't get it from the electric. So some of the carriers have looked at natural gas lines running to sites.

And, you know, there are any number of, you know, there are any number of ways to identify the issues, and we as an industry have really tried to. But, you know, it's, again, it's one of those areas where, you know, the -- it's the biggest of storms, the ones that there's going to be damage anyway, you know what I mean, that's unavoidable, right. I mean, some cell towers are going to have to have the antennas ripped off. And that's a tiny number, they're designed to resist most of that. But it's an issue that, you know, we look at it as an industry that we take very seriously and that we are trying to find solutions to go to that are both environmentally friendly, that will pass muster with zoning agencies and so on. So a lot of activity there.

And our personal thanks to the Commission itself, because when there are these storms, as she was saying, there's a lot of interaction with the Public Service Commission. And it's beneficial to, you know,

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to have the ability to identify, you know, where we need restoration, where roads are blocked and things of that nature. So the industry, you know, appreciates the cooperation and partnership with the Public Service Commission on that.

MS. CRAWFORD: Just to cheer us all up because we're all cheerful and resilient, all these issues go together. So a core principle of security and resiliency is redundancy. Having, you know, additional methods for getting online. Relying on a single network for large parts of New York State as your high speed Internet access connection is clearly a risk. You'd want to have additional modes. Maybe they -- maybe they cost some money to build, but it makes a lot of sense to have them. So it's yet another reason for fiber in the State of New York is for redundancy, security, duplicated network coverage. And backup storage for all of our data.

MS. ZIBELMAN: So just to, because I think this is something that's a very important point for the Commission. We are obviously looking at distributed resources and more of a resilient way of using distributed resources better. But clearly the connectedness among the various infrastructures is becoming clear, and as the electric industry itself is becoming more digitized and we start talking about the Internet of things, including all these aspects, it seems to me, back up to this point on cybersecurity and physical security, that while we have been very successful in getting our electric utilities to work with us very, very closely on terms of outage management, outage restoration, cybersecurity, that getting both the communication companies up to that same level so that -- because what we find is that if there's an event, waiting for Washington to tell us that we may be having a problem in New York is probably not a good solution. We need to know in New York we've got a problem. And then if Con Ed knows who to talk to at the communications companies, that could be a lot faster vehicle to making sure that understanding there's a problem, than waiting for someone to say oh, they happen to be in the same state, we'd better tell the electric utility that there seems to be lot of chatter on the line around New York. And so I think that unfortunately we are living in a world, when it comes to physical and cybersecurity, there's -- you can't do enough. And it has to happen at all levels. And just for everyone in the room, we are very active in New York, both at the local level, making sure that happens. But also I think the redundancy is going to have to be in the networks.

MS. CRAWFORD: And that also speaks to the possibility and potential partnerships between electrical grid managers and communities that are looking to find inexpensive ways to bring fiber. And that's been a very successful model across the world and one that New York State should have more involvement in.

MS. GEDULDIG: So you mentioned how -- I'm sorry, this is my last question on it, but to follow up on what the Chair was saying, I heard you say that you're such a draw -- that the communications industry is such a draw on the electric utilities, how much communication and coordination do you have with your disaster recovery and resiliency plans?

MS. HELMER: Yeah. I think -- I think, Karen, that it's mostly driven through the utility ERPs. And it's the utility ERPs that include all of the information about the local telecommunications companies and who they are and who the key points of contact are. So it's directed through them. Obviously each of the companies themselves has an ERP. And at various points we filed those with you as well, the CLECs are required to file them with you every year. So some of our companies have done that, and others have done it after times of emergency. But those types of issues are included now in all of the ERPs, largely thanks to the Commission's encouragement.

MR. McGOWAN: ERP is emergency

response plan.

MS. HELMER: Sorry, Peter. Yes.

MR. ARON: And I guess on the wireless side, you know, I'd say several things. So the Department of Homeland Security is -- has organized itself to make sure that that level of communication is happening. The quirk with cyber, of course, is that while the effect is happening in a state, right, the attack almost always originates elsewhere, and maybe not even in the country. So there's a lot of -- there's a lot of jurisdictional give and take there.

But to answer the question regarding, you know, the interaction between the companies, a lot of the carriers, if not all of them, have direct lines of communication with the operations center, the emergency operations center for the electric utilities in the affected areas. So, you know, step one would be making sure you're there, making sure that they know your situation and that you can then communicate with them where restoration is most necessary.

So, you know, that remains a dynamic -- a dynamic communication.

But the companies, like I said, the other point of this to stress is that, you know, the wireless industry has essentially set itself up to try to be as self-sufficient as possible when these things happen, right. So the -- there will be, you know, outages. I mean, we've all gone through electric outages, they happen. And what the wireless industry by large and has tried to do is set up networks in a way that they can promptly respond to the issues that exist. So that's, you know, having fleets of backup generators that they can haul in to hook up when it's necessary. That's having some generators at sites when possible. It includes having, you know, we call it the farmyard, right, the GOATs, which is the generators on trucks, the COLTs, cell on light trucks.

MS. HELMER: The COWs.

MR. ARON: Well, the COWs are actually useless for restoration. This is a common misconception. So a COW actually --

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MS. HELMER: They had them after 911.

MR. ARON: You can, but not quickly. You actually have to bring out a dedicated line to connect the COW. They're great for an event like the Super Bowl or for a parade because you know it's going to happen and you roll out the lines, right, you actually install the lines to connect the COW back to the network, but it takes a little while. So it can be done. But the first thing you'd see at an event is the COLTs would come out and the GOATs would come out, and eventually you'd roll out a COW. So, to your point, it certainly could happen, and it is another tool in the tool box.

But all of that is disaster planning, right, just in a big bucket of disaster planning. And the carriers practice it, they drill it, they go through, you know, drills that are with state agencies, they go through drills that are with federal agencies. There are regional drills. There are, you know, inside the companies they have teams that are simply dedicated to finding what the weaknesses are and how to better respond to them. And they drill this stuff, they live it every day.

And it's simply the reality that, you know, you can always plan for what you can think of, but then, you know, the next thing happens. And I don't think anybody thought half of lower New York would be under water, you know, before Superstorm Sandy hit, but it was. And one of the problems that all the networks had was an underwater -- was the under water lines. I mean, that's not good for any line.

So, you know, at the end of the day there's certain interdependencies and you can plan on them, but, you know, even the best plan will eventually be proved to have faults. And the question then is are you planning adequately. I think in our industry the answer is absolutely. I mean, I think we take it extremely seriously. We do take it extremely seriously. And are you reacting appropriately. And I think it's, you know, in

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the latter part that, you know, that really we excel. So we've looked at all of the things that have failed and we try to plan around them aggressively to make sure that the next time there's an event we understand what the weaknesses are and what the vulnerabilities are and we have the ability to react to those and make sure it doesn't happen again.

So, long winded, I'm sorry.

MS. GEDULDIG: It's a very important topic and we are obviously very interested in it.

So do you have any more questions? No?

So I think we've gone through the questions that we had planned for the panel and I think we're pretty close to the end of it. So I want to thank everybody for coming and for the robust conversation. I know it will being very helpful as we think about the recommendations that we'll make. And please come back tomorrow for round two.

MS. LERNER: Thank you. Can I just say one final thing? Which is that I -- that

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I would hope that one thing which the Commission and the staff takes away from the discussion today is that there really are two very divergent views of the broadband market. And hopefully that you will be digging deeper into the facts.

MR. KUSHNICK: I'd like to ask a couple of questions. My name is Bruce Kushnick. I'm Executive Director of New Networks Institute.

How many of you read the Verizon New York 2014 annual report? I didn't think so. I'd like to give you some highlights.

First, did you know that Verizon -- the Verizon construction budgets have been moved to the wireless department, division? According to the AG, in 2011, 75 percent of the budget had been moved to either pay for FiOS or for the wireless departments, both deployments. I.E., instead of going to the local service part of the -- instead of going to the local service part, the construction budgets went to pay for the wireless division.

There's a problem with this. In

2009 Verizon received a rate increase for massive deployment of fiber optics and losses. The losses were created, based on the 2014 annual report, Verizon local service paid 60 percent of the -- of the corporate operations expense, $1.6 billion. Verizon local service only brought in $1.4 billion. There's a little discrepancy. Why did local service, which only brought in 27 percent, pay for 60 percent of the expenses, you might ask. Because Verizon has been able to manipulate all the books to be able to fund all of the other lines of business.

Let me give you some other examples. Special access in New York made $1.8 billion. According to the FCC, 60 percent all special access lines are based on copper. Those copper lines are not counted in the number of access lines that are included.

In 2007, there were 47 million total access lines in the State of New York. By the end of 2014, there was an estimated 65 million local access lines in the State of New York. Why does Verizon claim there's only 2.7

million? Because Verizon is only counting a subset of all the lines.

Now, if you go through all of the -- if you go through all the affiliates, you'll find out that Verizon basically has dumped all of the local expenses -- all of the expenses into local service. This was done because under the FCC's accounting practices in 2001, they set the accounting percentages for all expenses by the year 2000.

The State of New York has never done an audit for 15 years of any of the affiliate transactions. The State of New York and the FCC has never done an affiliate transaction. What you find is that 75 percent of all expenses for construction were dumped into intra-state services, because of the 75/25 percent rule. This means that all of the construction budgets have been basically dumped into local service. Local service. So Verizon New York lost $2.6 billion in the year 2014. Over the years between 2009 and 2014 it lost $13.6 billion.

Now, what I'm getting at is very

straightforward. Because of the FCC's rules, which can be changed, Verizon local services has all of the expenses but none of the revenues, because the revenues are going down. Where are the revenues going? They're going into other lines of business, which are not being accounted for.

Special access, which is $1.8 billion, is down largely to local service. But all of the special access lines, zero number of lines have been accounted for. There are 65 million special access lines, or special access line equivalents, which are not being accounted for.

The report I wrote prior to this was by -- called It's All Interconnected, that was published by PULP, that became part of the Connect New York Coalition's document -- petition, which called for audits of the books. We know for a fact that the majority of the wireless expenses for construction was dumped into local service or into the construction of the intra-state side of this. This is the known as cross subsidization. The reason why local -- so, according to CWA and IBEW members throughout the United -- throughout the East Coast, we have been told pointblank that they have been moved from doing the wires to the homes, they're doing the wires to the cell towers. In short, the reason why New York State's upstate cities are not being wired is primarily because the money's been diverted. If Verizon local services and all of the affiliates were paying its fair share, including special access, including FiOS, including the wireless service, it would be profitable. There would be enough money to spend to go out and wire the rest of the state.

The petition from -- the petition from Connect New York Coalition called for an investigation. We have just filed two reports, called Fixing Telecommunications, within this docket, which basically shows all of this stuff I have just talked about. What you'll find is that the FCC's own data shows the number of access lines, special access lines, was 47 million in the year 2007. We estimate it to be 65 million. We have a chart that shows this.

The bottom line is that none of you have looked at the financials of Verizon New York which have been filed with the state. There is no other state that actually collects an annual report that we know of. The FCC has stopped collecting all of this data in the year 2007. And the bottom line is if you want to go out and get New York State wired and you want to lower prices and you want to make customers whole, you need to do audits and investigations of all of the affiliate companies' frozen money between the state utility, Verizon New York is the state utility, and all of the other lines of business.

Thank you.

MS. GEDULDIG: Thank you.

MR. BRODSKY: I don't have a statement but I want to put into the record the statement of Robert Masters of CWA. We had hoped for an opportunity to have that presented today, we weren't afforded that opportunity, so I ask that the statement be made part of the record.

MS. GEDULDIG: Okay.

MR. YAKEL: And I would just like to remind people that tomorrow is the third panel. That panel will take place not here but at New York Law School. So if you plan on attending that, please remember that the location is different than this location. Thank you.

(Time noted: 3:45 p.m.)

C E R T I F I C A T E

STATE OF NEW YORK)
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I, KARI L. REED, a Registered Professional Reporter (Stenotype) and Notary Public with and for the State of New York, do hereby certify:

I reported the proceedings in the within-entitled matter and that the within transcript is a true record of such proceedings.

I further certify that I am not related, by blood or marriage, to any of the parties in this matter and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 2nd day of March, 2016.

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KARI L. REED, RPR