2022 ConnectHomeUSA - Broadband 101 Connectivity Solutions

Dina Lehman-Kim: Thank you so much, Teresa. Good afternoon, everyone. My name is Dina Lehman-Kim and I manage the Connect Home USA Initiative for the Office of Public Housing Investments in Bethmont. I'm very excited to welcome you to this installment of the Connection Home USA Quarterly Webinar Training series Broadband for Public Housing, or we've also called it "Broadband 101 Connectivity Solutions." This training is quite timely. As many of you know, historic levels of federal funding for broadband is becoming available.

And so today we are very fortunate to have two broadband experts to walk us through the various types of connectivity solutions. And let me just take a quick moment to introduce them. Christopher Mitchell is the director of the Community Broadband Networks Initiative with the Institute for Local Self-Reliance, or ILSR. He's a leading national expert on community networks, internet access and local broadband policy.

Christopher built "muninetworks.org" the comprehensive online clearinghouse of information about local government policies to improve internet access. He will be joined during the Q&A portions of this presentation by DeAnne Cuellar, who is ILSRs Community Broadband Outreach Team Lead. DeAnne is a tech equity advocate and communications strategist from San Antonio, Texas. She brings over a decade of experience in tech equity planning, strategy formation and community organizing to her role with ILSR. With that, I will pass it to Christopher. And thanks everyone so much.

Christopher Mitchell: Thank you very much. And thank you all for coming out. This is a topic that is obviously close to my heart as well as that of DeAnne. And we're excited to go over a number of different issues around what we think would be best for you to know. And then we have a lot of opportunity for Q&A, both about two thirds of the way through the presentation and then again at the end to make sure there's plenty of time to ask questions. Feel free to ask questions at any point. I will probably steamroll them right up until we get to a good stopping point, unless it's something that I can cover well, but if you just throw it in the chat when it comes up that way, it won't get lost, and we'll be able to cover it.

And with a group like this, I like to say that if you have a question, someone else has the same question. So you could be the hero and ask it for the other person that might be a little bit shy because it's rare that one person is the only person that has a question when we're doing a presentation along these lines. So don't be afraid. We know that many of you are not technologists as you're your first passion or your first calling. So feel free to ask the question in the way that it comes to you. And don't worry if it's something that if you're not sure, you're phrasing it correctly. The important thing is to get the questions out there.

I'd like to start off with a focus on the big picture. And the big picture is that for many people, internet access still seems a bit new. It seems, I think intimidating. It seems like it's confusing in ways that we pretend we don't think of electricity as magical. I think for most of us we grew up with electricity and it's just something that's been there in internet is something that came along after we'd already been developed. And so we still think of it as something new, but we are

moving to a time when internet access is much like other utilities. It is, I think it's so expensive in many places. It can be hard to reach for families that have specific challenges.

But we are moving into an era, and I fundamentally believe that in the next decade or two, just about everyone will have internet access the same way that they have other utilities that are commonly available. There's going to be challenges along the way for sure, and we still have work to do, but this is something that. Will be taken for granted and we'll be seen as being as scary or intimidating as it is right now. And what that means is basically, I can go out to a store, buy a device, come home and I know that the electricity in my house will support it.

And right now, for a lot of people, they don't have internet access in that way, but over time they will. That's what I'm talking about. I don't do a lot of time talking about megabits per second or deep technology things. I'm so happy to engage in those discussions, but I think it's more productive to talk about this in the way that most people do without having to get very technical. So my presentation will avoid a lot of the Jargon wherever possible. One of the things that I like to keep in mind also is that when we talk about internet access, it's important to understand that we're talking about households.

We're not talking about devices. What I mean by that is for the 15 years that I've been working on this issue, the one of the things that happens frequently when we talk about what kind of access people need in the home is someone will say, "What are you going to do with that kind of speed? What do you really need that level of connection for? What's what is your computer going to do that needs that?" And it's not really the right question. So I'll sometimes say that we are freeways that are two, three, four or five lanes wide, right? And it's not because we're expecting someone to build a car that is five lanes wide. That would be fairly absurd.

But we recognize that on networks like on freeways, you have a lot of different devices who are trying to use the same connection. So when we're thinking about what a household needs, that might be a household of one person in some of the living situations of people that you're working with might be a household that's much larger than that. And what we're seeing is that most households have a lot of connected devices. And so it's whether it's your reaction or the reaction of someone that you're talking to, if you kind of get in this idea of what is a household need and then you start thinking about what a single device needs, you're probably going down the wrong path.

The question is what kind of a connection will allow all of the devices in the home to be able to work the way they need to without having congestion? And so that's another piece of understanding networks, is that like highways, congestion is bad, right? We could park a lot of cars on the highway, we could park many more cars on the highway then can drive on it effectively. We don't view that as a good use of that manufactured space. We recognize that there's a peak flow that we want to have, and you have to have a certain amount of capacity in order to do that and even though you could fit more cars on the highway, it becomes less desirable to do so.

Networks are not meant to run at 100 percent capacity. A good network is half utilized or less. And so one of the issues that comes up is we think of it as a crowded bar problem. And that is to

say that if you're in a bar with other people and you feel like the bar is getting louder. Then you start to shout a little bit louder to the person next to you. And all of the conversations are escalating until nobody can hear anything. And that is what happens on networks when they become too congested. So any discussion about what households need, that is premised on the idea that "Oh, that's too much," probably going in the right direction.

When we're over provisioning. We are we want to make sure there's plenty of room to grow and there's enough room so that even in extreme circumstances where a lot of devices, maybe you are having a dinner party and that sort of thing that the network will still work. Much like electricity will work on those hot summer days when everyone's really pushing it to the limit. So keep trying to use my arrow keys rather than the napkin. Now, when we when we talk about internet access and what is lacking. It's important to understand that that word access, it is confusing for everyone.

 It's not just you who might be wondering when they say a person doesn't have internet access, what does it mean? I read a lot of broadband articles and whenever I see the word access, the first thing that happens in my brain is I wonder, "Okay, what kind of access are we talking about?" And that's because the word access could mean I live in a rural area or a tribal reservation or even a small number of people in the urban areas where even if I had $1,000,000. I'm not able to get connected to the internet because there is not infrastructure that's either very close to my house or on my house.

That is one type of access and there are on the order of 10 to 20 million American families where we believe that there is a lack of infrastructure. That is one kind of access. Another kind of access is more common. And here in this slide, the number is put at 26 million by, and this is a slide from the National Digital Inclusion Alliance, which is a wonderful organization. I think they might be a little bit conservative here. I actually think it's more on the order of 30 to 40 million households, largely in rural areas. But this also can happen in rural areas where there is infrastructure available.

They have access in the sense that there is a wire or a wireless connection that is available to them, but they don't have access in the sense that it's not really open to them. They may not have the money to pay for it or they might have bad credit and the owner of that wire may not want to turn it on for them because of that issue. They might not want to use it because they have a lack of digital skills, or they don't have devices. This is also called the lack of internet access, and it's somewhat confusing. I try a sale often, but I try to use the term availability to talk about infrastructure lacking. And so when you hear that people don't have internet access, you should feel very emboldened to say, "Wait, what kind of kind of lack of access are we talking about here?"

Because the solutions to a lack of devices and affordability can be different than the solution to a lack of infrastructure availability. So that's just to give you a sense of the general scope in both rural and urban areas. We have a lack of infrastructure in some cases and in both rural and urban situations. We have people that lack access because they do not have the right digital skills, devices, training or along those lines. So the next piece is talking a little bit about what we're seeing in terms of how we reconcile the lack of infrastructure and what we do about that.

The question about funding, yeah, we can absolutely cover funding in the Q&A the a little bit and talk a little bit about funding in the example toward the end. But that would be a great thing to bring up in the Q&A. We can talk about it there. The Affordable Connectivity Program is a new program that I'm hoping that all of you have heard of. You might not all want to take a quiz on it right now. But I'm hoping that you've all heard of it. This is the successor to something called the Emergency Broadband Benefit. And this is, both of those were programs to subsidize the cost for households getting internet access.

That's one of the ways that we've been dealing with the problem of people who are not able to afford connectivity in the recent years since the pandemic started. If I step back for a second, when the pandemic started, the lack of internet access for some households, which I would say includes both infrastructure and the lack of ability to afford it. Really became a higher priority for many in government and elsewhere. And we think of the response as falling into two main buckets of responses to try and make sure people are connected. One of them is much more short-term, short-term focus, and I think of it as a life raft network or sometimes called a gap network.

The other solution is more long term focused and that is a solution that will permanently solve the problem at some reasonable cost. What I mean by this is we should be thinking both short term and long term. And the important thing is to understand the short-term solution probably isn't going to work well in the long term. And the long-term solution probably cannot be implemented in the next 12 months. And so we need to think separately about how we're dealing with this, these problems as we try to make sure that people are well served.

So when we think about the first shorter term solution, which I think of as a life raft, which is something that is absolutely essential in the moment and not so great to plan on spending the rest of your life on, those are the short-term approaches. We also have I wanted to highlight some of the other I would consider these short-term solutions, but we have programs from the major cable and telephone companies that often offer a low-cost connection to people. These are things that can be done immediately in terms of helping people get connected. In the longer term, I don't think these are going to work very well. So in the case of the Gap network, these are typically networks that don't reach into the home. These are networks, for instance, San Rafael, Providence, San Rafael in Marin County, Providence Rhode Island.

Pittsburgh has Meta Mesh. There's a number of these networks that have been built often at no cost to users. They're often wi-fi networks that are available in streets or in community centers where people can go and access internet for free. Often, it's a decent quality, but we really need to make it available inside the home. The lack of availability inside the home is a key, a key differentiator between the life raft and the long-term solution. The problem is, is that getting inside the home requires a lot of logistical challenges, as well as challenges around building trust with people to make sure that they will be wanting to use it effectively and gaining all of the skills and the device that is needed in order to get it.

So the life raft network is one that is quickly built. Often Philanthropy. Philanthropy. Often wireless based Wi fi technology. Often that's available outside the home because of the difficulty

of getting it inside the home. Then we also have these plans that I would consider a short-term base too, as well as the ACP. I think it is also being a short-term solution. Much of the examples I'll be giving toward the end are the longer-term solutions. To give you an idea right now, the ACP, based on our modeling and I have a slide that will talk about this toward the end, but the ACP is spending on the order of $400 million per month and we'll run out of funding at some point in 2024 based on various projections.

Depending on your political optimism or pessimism, you might think that there will be more money put into it or less. There may be money refilled into it before it ends or not. I think many of us are worried that it may not be refilled, and it may run out. So that's why I tend to think of these as short-term solutions. Longer term solutions will be things that can be maintained without needing extraordinary policy efforts. They're going to be more elegant solutions, as we used to say, in the computer programing world when I was a part of that.

The solutions that can continue to go even if budgets are cut and networks that are able to largely self-sustain without needing significant new appropriations. So that's thinking short term and thinking long term is not a perfect line in between. But I think it's helpful to be thinking about both of those phases separately. These are some of the examples of some of those short-term networks. The gap, the Gap networks or life raft networks a lot of these were focused on Wi-Fi. My favorite one, though, hands down, is an electric co-op in Arkansas, which took trenched fiber, you see in that picture in the lower left, to a school bus.

School busses have been used all around the country to deliver access. They park them in areas where there's a high need. In this case, they wanted to make sure that that school bus could deliver the fastest Wi-Fi possible because the wireless that was supporting it in the area was not able to meet everyone's need. And so they trenched fiber to a school bus, which is seems somewhat silly. The reason is that the school bus provides security and weather protection and that sort of thing. And so it certainly makes sense. But it's also funny visual to imagine if the school bus was driving to have a fiber dangling out the back and being coiled up and that sort of thing.

So we've seen communities do a lot of different things to try to build these networks quickly to get people connected. Here's that dashboard I mentioned. It's ACPDashboard.com and one of the important things to think about, we are thinking short term, isn't to say, "Oh, these aren't good solutions," these are good solutions, they're good short-term solutions, and we should maximize enrollment. When you look at that map, there's not a lot of places that have even hit 50 percent signups for eligible families, eligible households to be getting this discount. The Comcast Internet Essentials Program has been around for more than a decade, and there's a lot of people who still have not heard about it.

So in the short term, it can be a really terrific to make sure that we're taking advantage of these kinds of programs that are out there even if we don't think they're going to serve the community best over the longer term. So we're going to get into technology a little bit here, and I think it helps to start off to just talk briefly about how the internet works, how the telecommunications networks that the internet runs upon, how that comes together. Internationally, there's a bunch of

fiber optic lines under the oceans. This is how most traffic moves between countries. It doesn't use satellites as much.

There's some satellite access, but the vast majority of internet traffic goes over fiber optic cables. That even includes your mobile traffic in ways that we'll talk about in a few minutes. But there are fiber optic lines on the ocean floor in lots of places running around and making different connections. As we go into the United States now, we have what we think of as the backbone of the long-haul networks, and these are the interstates effectively. These are fiber optic lines that run between generally major population centers and that will be serving the majority of the traffic.

In fact, right now, almost all of you, since I'm in Saint Paul, Minnesota, and many of you are somewhere else. You're seeing me because of information that is running over these long-haul networks and as the signal goes out from me, it will, first of all, before hits the long-haul network here, we're going to actually zoom in. You can imagine if I was in Baltimore, for instance, there's it would go from my house to what we think of as a central office or some location locally where whoever owns the network that you're using. Interconnects with other networks. And that's what happens in these dots here in Chicago, Ashburn and New York.

Each have major areas where there's hundreds of networks interconnecting, and network is transferred from network to network. So I'm on one cable company network. Many of you are on different networks. This information is going from my house into these areas on one network, and then it crosses over to a different network that you're on. It might go through a middle network in between to get to you, but this is what happens basically in terms of the backbone and the long haul between cities and between internet service providers or networks. Now, as it gets closer to you or as of leaving your home.

This is the last slide along how the internet works. If you look at the Baltimore Data Center there on the left, imagine that you're in Baltimore right now. My information is coming into you from Chicago, most likely. And then it is coming out and you're on let's just say you're on Bob's ISP. Bob's ISP has this place where it's picking up the traffic from other people in this Baltimore data center and then Bob has a network in Baltimore that runs probably along major arterial streets. They might connect a number of different facilities and it goes all the way near people's homes and as it gets close to the home is what we call the last mile.

So I'm on a cable network and a few hundred of my neighbors and I are all on a last mile of a coaxial connection which is just that thing we used to plug into TVs before we had HDMI cords and that coaxial connection at. Some point around here within a half mile of my home, I'm sure the cable company has a box, a pedestal, we'll call it on the in someone's front lawn, probably someone who's annoyed by it or in an alley and there it connects to this middle mile, basically, which then runs to that Baltimore Data Center.

So similarly with wireless, if you're on a wireless network, you have a device, whether it's a mobile device or a fixed wireless device. We'll talk about that in a second. But what happens is information is transmitted wirelessly. Probably if you're on a Wi-Fi network, probably just within tens or hundreds of feet. And then at that point, it's probably on an Ethernet cable or a

fiber optic cable, which is to say a wire. And it's running the whole rest of the way to wherever it's going on those wires. It's very rare that we have satellite for most of us. I think many of in popular imagination, our cell phones are talking to satellites, they're generally not. They're generally talking to some kind of connection that's near to you and that is running on to a wireless device that might be on someone's rooftop.

It might be attached to some stadium lights, depending on where you are. There's a wireless device that receives our signals and then it puts it on a wired network. That wire network will go to a local data center where it will meet other networks and it will be transferred to where it is supposed to be going. That's not the clearest I feel like. There's certainly can be more about that if you have questions about it. But the key concept that you want to have in mind are basically that within your neighborhood. Your homes are aggregated together in some way with others. All of those connections go to a similar point.

Eventually, from that point, they can transfer to other networks and then it will the process will be reversed to get to the person's home that you are communicating with or something along those lines. The technology now to do this, we're talking about public housing, which is, I hope, why most of you are here. The reason that we went through all that is because when I was working with folks in various places on trying to figure out innovative ideas to connect public housing facilities, one of the first questions is do we have a way to get information from that building to a place where we can get it on the Internet with a high-capacity connection?

And there are different ways of doing that both using wireless and fiber optic opportunities. In some places, you will have a city institutional network. This is a kind of network that a city will often build to connect its police stations, its main city hall facilities. If it has a water utility, an electric utility, any sort of surveillance technology that it uses. Metro transit agencies will often have fiber optics or networks to connect their facilities. These sorts of things are all running around the cities. And so there may be fiber optic connections near you that you would be able to use.

This is because we think about it within the building. If we think about a building, whether that building has 20 units or 50,000, probably not many of you have to worry about the issue is basically you have two challenges to bring physical Internet access to units of that building. One is you need to build the local connection to distribute a signal that you can get to the property. So whether you're on a campus or whether you're in a large building you need to figure out how you're going to distribute a signal within the building so that every individual unit can access it. That is the local distribution problem.

The other problem that you have is how do you get from the building to the wider Internet? And that's the problem. That's what we're talking about here is the getting on the municipal fiber that may be available. There may be private companies that are available, although the big cable and telephone companies are usually not going to want to lease you a line because they would prefer to have a bulk deal with you where they take care of it, or they would prefer that you basically leave it to them in a different way.

So there's different ways they'd like to engage with you, but they generally don't want to offer you a lease to connect that building because that's the way that they will have the least amount of profit potential from serving you. And finally, if you're not able to find someone to lease from and the municipality and local public agencies don't have a network that you would be able to use, you certainly would be able to build a fiber network yourself to run to a point and the building might be a few blocks away from another point where you could get a high-quality Internet access connection.

You are able if you would like to build that connection yourself in most cases. States have different rules around these sorts of things, but in most cases, you would be able to build a fiber optic line off of your building or your campus to make that connection as needed. But it can be expensive. So that's why it's preferable to find a city institution on that work or a reasonable lease. The other option, and this is one that is very common and can be very high quality is a point-to-point ratio. So this is where we can talk for a second about different kinds of wireless technologies. People who are familiar with mobile wireless, that's probably all of us. If you have a device like a 4G phone, a 5G phone.

These are mobile devices, and we call them mobile devices because they move around. There's antennas all over the city. There's a lot of engineering that goes into allowing your device to skip from antenna to antenna because your device is moving. That's why we call that mobile wireless. Mobile wireless can be expensive for people to use for monthly connections, which I think is something that everyone's familiar with. It's gotten a lot better. We're back into an era of unlimited data from time to time. So still not super effective.

Not as reliable for people that are depending on it. And often it's quite limited in what you can, how much, how much you can transmit each month before you get limited down. So we typically don't see mobile wireless as being a great solution for people in public housing or for anyone else who is trying to engage in the Internet access, for education or other reasons. It's just expensive and not the best technology. Mobile wireless is a more common wireless, but fixed wireless is very popular and growing. Particularly for this kind of situation that we're talking about here. It's called point to point or fixed wireless because it's two fixed points that don't move.

You would put a device on your roof or on the side of your building, and that would be aimed at another device that is probably on a tower somewhere. That tower would be connected to fiber. And so you would ideally be doing one hop, which is to say one hop from your rooftop to the tower, and then there would be a high-quality connection there. But there could also be additional hops depending on where you are, particularly in certain terrains or if you're not above the treetops, you can sort of skip around to get to that place. But here we're focused on "How do we get a high-quality connection to the building itself?" And the case study that I'll talk about first at the end of the discussion, we'll talk about this.

And that's where the image comes from here. But that's on a rooftop. This could be as simple as putting up a tripod, anchoring it with concrete block, making sure you have electricity up there, setting up a point-to-point radio and then using that to get a high-quality signal to the to the building. And I think the next slide will elaborate on this. So either at this point, we either have a high-quality connection to the building from a fiber optic line or from a wireless point to point

on the rooftop. That means we probably have hundreds of megabits or a gigabit there. I said megabits and gigabit. I said I wasn't going to get into that. But the point is, is you have a large connection, and it could even be multi gigabit for certain larger facilities.

The question is now, "How do you make sure that everyone can share that?" Because that's ultimately what you're going to do with that connection. And there are different approaches. The ones that I think are better, tend to be wired candidly. But I'm happy to talk more about that because there are tradeoffs. There are not simply just here's what you should do in all circumstances. One that is less common but may become more common over time is fiber optics to the unit. And you can actually do that even if you have a wireless signal coming into the building.

So let's assume for a second that you have a place in the building, which is a secure environment, which, depending on the solution you're going to go after, may or may not be one that would allow different companies to send a representative to, for instance, if you would have multiple companies that would be in the building to connect people. This is sometimes called like a telco closet. But basically, you have a high-quality connection coming to either the roof or coming into the basement from a fiber optic cable. And the question is "What happens to it next?"

You want to get that to a place where you can manage it, a place that's sheltered and this is ultimately where you're going to be running all the wires to the rest of the building from this telco closet. In some cases, they might have a room on every closet, not a room so much, but a closet on every level of the facility usually up and down from the same location in terms of the building. And then you can go you run the wire up and down to get to the other rooms, and then you distribute it on each floor coming out of that closet. But you need to organize all this stuff in some way is what I'm getting at. Now, you could have fiber going from the unit to the telco rooms or the telco room.

You could have Ethernet. Ethernet, it's going to be the most common. And Ethernet is probably the best. In terms of ease of use and that sort of a thing. But fiber is kind of the one that's future and I think it's probably more of a headache than many of you want to deal with today. But I'm saying it wouldn't be crazy if you're hearing that some people are using that it may become more common in the future. With even that, we're often going to be talking about Cat six, Cat six E, Cat five is okay, but at this point, if you're doing something new, you want to be using a Cat six or Cat six E, standard I think, to make sure that you don't have to touch it again for a very long time. The reason that I really mean in favor of wires is because wires work.

Wires and that's not categorical. Some ultimately may fail, but when you have a wire that works, there's very little that will change over time. Whereas wireless, there's a lot of more points of failure where things can go wrong, you can get dead spots but ideally, from my point of view, you would like to have a wire to every living unit to be able to deliver access to that living unit. Within the living unit and you may very well once to either give the option or yourself turn it into a Wi-Fi signal again. That is certainly possible. But you want to have a wire that goes from the units back to this telco closet or to someplace where you can connect to that high quality signal that is coming in from the outside.

The reason for that is that we're talking about decades in which you probably won't have to touch this again unless someone is digging around in the walls, drills through it, or something like that, which is very unlikely. And the Ethernet cables can deliver very high capacity and they don't have to replace, and they just sit there and work year after year. If you want to distribute the signal within the building wirelessly and you're likely going to be using Wi-Fi and this is okay. It's certainly in fact what's best is frankly a little combination of both in that people want Wi-Fi devices.

Now, if you're going to try and just put Wi-Fi routers in the hallways, you'll find that in some rooms of the of the living units, they may not have very high-quality connectivity because Wi-Fi is a giant pain in the butt. Wi-Fi will have different weird dead spots. It can change based on how people are moving around, it'll change based on how people arrange their furniture and other units. Wireless just sort of moves around. And so you have Wi-Fi interfering in that, you may have a person that turns on their own Wi-Fi network and suddenly the hallway Wi-Fi doesn't work as well.

There's just a lot of challenges and that's why I would not want to rely on Wi-Fi as the first option for connecting people. The second issue is that the way Wi-Fi would work in a shared environment is that every device is treated as being unique. And so if a person has a Wi-Fi printer, they may not be able to print to that because, the Wi-Fi network doesn't know how to tell the difference between people in one unit from a different unit. And we don't want to share information across it for security reasons.

So and there's different ways of dealing with this, but there's a number of headaches that come with a reliance on Wi-Fi as the primary method of connecting people. So it can be less costly upfront to just say it's just Wi-Fi in the hallways. The long-term costs may be much greater. The cost of wiring, a home or wiring buildings, many of you will have a better sense of this, but for more modern buildings, my understanding is it runs in the, if the building is not yet completed or is undergoing substantial rehab, tens of dollars perhaps to run those wires, if the building is not in substantial rehab it might be in the low hundreds of dollars.

If it's a very old building with hazardous materials, then it may be in the many hundreds of dollars per unit. Those are all one-time costs, and you get that done right. It's a very wise investment because you don't have to send someone out every time the Wi-Fi is acting up in the hallways to try to figure out how to make it work in one unit without breaking it in a different unit or that sort of thing. The long-term costs of running the wireless as the primary method, running wireless in the hallways can be quite substantial.

So I would be very concerned about that as the number one solution. Now, another technology, and I think this is toward the end of your 30 seconds. Yeah, that's what I thought. So the last bit here is the is CBRS. And this is used in a variety of circumstances to connect people in both campus style as well as large building public housing, as well as single family home housing. This is a technology that is more recent, although we now have a fair amount of experience. Many cities and even public housing agencies have used this a lot of it was built in the past year to 18 months, often as a result of grant cycles that helped to create it.

But CBRS is a wireless service, and what is particularly valuable about it is that you do not have to wire the home, most likely. So particularly when it comes to single family home, Section 8 environment, this is going to be that's the hardest problem to solve because if you imagine having to wire 100 homes is, rolling trucks, getting people out to those homes dealing with it, it's spread out all over the place, whereas wiring 100 units in a building, you just sort of you get there, you start on Monday, you just work your way through, you're in the building, you get a sense of how it works.

You get efficient at it and it's much more reasonable to do so. Getting homes connected themselves is difficult because you have to often get into the home and get a wire in there and then potentially get a device in there that will allow them to use Wi-Fi. CBRS circumnavigate that generally. CBRE basically uses a similar technology that our mobile phones use, but it then can be turned into a Wi-Fi signal in the home by giving the homeowner a pocket to take home.

So let's say this. This is a hard drive. This is not a CBRS modem, but this is roughly the like the form factor. You don't have to send a technician to the home to install it. And this is in some ways the Holy Grail, because you have an event, you hand out these devices, people go home, they plug in electricity, "Hey, Presto," they have Wi-Fi that's the dream. CBRS is in some areas delivering on that in other areas. There's a lot of challenges with it. It is more expensive than we hoped it would be.

My second example, I'll talk about a little bit more about this with regard to y zone in Yonkers. But it is fairly costly for a technology that does not deliver super-fast broadband speeds generally because you will have to balance out the number of people that are sharing this service with the amount of speed, the amount of capacity that you can share on the network. So if you want to deliver very high speeds, you're going to be paying a lot per family because you are basically sharing it with fewer households.

If you want to maximize the households that are able to use it for any given sector where you set this up, then you're going to be delivering less speed per person because you are limited in how much spectrum you can have. I mean, you can just think of it as like the classic piece of classic pizza pie. You have a pie, and you can either give a lot of people small slices or a few people big slices. Ultimately, you can't just create unlimited pizza pie, which is unfortunate. So we'll talk more about CBRS. What's important about this is just that you don't really have to get you don't have to get a license from the FCC.

This is something you can work with companies like Motorola. I am not going to say others I'm not 100 percent sure with but there's other companies that have different solutions you can work with on this to get this out. This gets closer in my mind to that original concept of the short-term Gap network. I don't think you want to think about this as a 20-year solution. I think you want to think about this as "You know what, try to get connection to our big buildings." It's going to take a while. We want to run Ethernet to every unit to make sure that we're able to deliver that high quality connection. And we have to go through hazardous review. We have to work with all these families to get a time when we're going to get in. Let's do CBRS, that we'll get something out there to people that will be affordable and it will not be the great super-fast connection that they dreamed of. But it's something.

And then over the next three to five years, we can resolve this and we can get into the homes and do these installations and as you do that also, you can get more people. What I'm trying to say is you do CBRS, you get it out to 250 homes, and then over the next year you get 100 of those homes that are connected to an alternative means with the wire, to the Ethernet cord wire to their unit. Now you have 150 people that are using the CBRS. We're getting a better experience over time so you can mix and match these things and that's how you should be thinking about moving forward. So Q&A break.

Also, Chris gets a drink of water. I feel like there's areas in there that weren't the best that I've ever done in terms of trying to keep it clear. I would much prefer doing this in person. It's always a little bit awkward. So I'd love to see questions any, any additional points people would like. We've got some time for Q&A and then we're going to roll through a couple of examples in which public housing has worked through these challenges and what the headaches are. So I'm looking in the chat for any questions and then also, if anyone else has any, just any of the Dina or anyone else who has the ability to speak.

Annelieske: Yeah. Thanks, Christopher. This was a great overview. We have had a few questions in the chat and the Q&A, and I would encourage people to continue submitting those questions. Like Christopher said, he is here as a resource. He is happy to answer questions to the best of his ability. All right. So Christopher, we do have a few questions that are related to ACP. So I will go ahead and pose this to you now. First one is "How do we help people with the ACP enrollment process when we cannot recommend one service provider over another?"

Christopher Mitchell: That is a very good question. And in fact, this is where also I think DeAnne may be very helpful. DeAnne has extensive experience along these lines. Let me give a quick answer and then see what DeAnne would say one is I think that in most cases, you should be able, I think to narrow it down to those that are active within a given area. So hopefully you can say this is a list of ACP providers that are relevant in this area that you could choose from and try to make that available because I think in some cases the resources that are available do not correctly list all of the ACP providers in a given area.

So just actually filtering that list correctly might be a good step and beyond that, I think one thing that I've said, and this may be different for different areas, but I feel like it is difficult to advocate for a specific company. I feel like one could do a process in which you are open for companies to explain what they're doing in your area and then you could present that information. So for instance, you might not say, "Well Comcast Internet Essentials is what you should go with," but you might say "Well, we did this process and these three companies are the ones that responded with more information about their programs, and that could help tailor it a little bit."

And I guess the other thing I would say is that you could try and partner with organizations that are more free to be candid about their sense of what they would recommend.

DeAnne Cuellar: Absolutely. And I will add two more answers to what Chris just said, that and this is I have two more answers to what Chris just said. One is to add value to what's already been stated is that if you do a virtual fair or if you do an in-person resource fair, is make sure that

all the Internet service providers available that are serving the participants of those events so that all the information is available, so that that cuts you out of the loop of saying it's one provider over the other. And the second thing that you can do that takes a little bit of coordination is that you can make you can make a list that doesn't mention service providers this based on speed.

So if a certain speed only like one service with one speed is available to the households that you're serving, you can have a conversation around how many people in the household are going to be connected to the Internet. So to give you an example, if there's one person in one household, like an older adult living alone, they might qualify for ACP and it might cover the entire cost of the speed and the service available.

However, another scenario might be household, where it's family four with two parents and two public school students. They might also qualify for ACP, but they might need a different speed and a different service based on how many users are in the household. So those are two different types of conversations you can have with the households to help them make decisions without mentioning any companies.

Annelieske: That's great. Thanks, DeAnne. Christopher, we do have some questions related to the CRBS. The first one is asking "How can a community access CBRS?" And then another question is, "What is the price point?" And they're asking, "On average with basic use, how many homes within a building can be connected to CBRS at once?"

Christopher Mitchell: Sure. Let me cover that. The main part of that in the example of Y zone. I'll be talking about that a bit. I'll talk about some of the numbers there. But the question about if you're interested in it, what do you do next? This is an interesting question. You need someone who is somewhat technical, I think, to at least, be a liaison on your side. You may want to reach out to vendors. In fact, let me say that probably everyone here has received phone calls from companies who have CBRS solutions. So they are probably beating down a door, a path to your door potentially.

But one of the things that I would strongly recommend is reaching out to places that have done this. So for instance, the Y zone in Yonkers, which I'll talk about, I would reach out to them to ask them their advice. Likely you will be able to work with a consultant if you don't have the technical capacity on your staff to set it up and run it. There will be a consultant that would work with you. Another thing would be a local ISP that you have a good experience with. You might be able to set up an interesting trade in which, for instance, in Saint Paul, I believe the city of Saint Paul has rooftop access for $1 per year to all of the rooftops, the Public Housing Authority and that is really attractive.

And there's private companies who might be willing to run a CBRS and give you a substantial discount on it, even if they were able to install their gear on your rooftops. So there's a variety of local issues you have to work with lawyers to figure out how to arrange those sorts of things, but I am well aware of schools that have partnered with local companies to do wireless solutions that have substantial public benefits. So there are ways to navigate this. And in most states, as far as I understand it.

So there's consultants to check in with, certainly talk to someone who's already been down this path. I think I think the Public Library in New York has been working on this as well. New York City. And a good place to find these people is the National Digital Inclusion Alliance web email list. If you're not familiar with NDIA, National Digital Inclusion Alliance, that email list is terrific, and you can get a lot of good questions answered there. Talk to people that have had different experiences.

Annelieske: Thanks, Christopher. And we look forward to hearing more with the wise on example in a little bit. So one question that came in was asking if you could please explain the difference between 5G and millimeter wave technology.

Christopher Mitchell: Yes, this is a very good question. And the whole 5G thing is, is it's like Internet access in that 5G, I think is ambiguous. So because there's also 5G, which is a mobile standard, a mobile wireless standard for our phones as well as five gigahertz, which is a spectrum band that's Wi-Fi uses, and it's also used for delivering home Internet access over fixed wireless. And then we have millimeter waves and all of this stuff kind of runs together. Millimeter waves are typically used for fixed wireless solutions, which is rooftop. In fact, I can pop that back up here and the reason to stare at a blue screen.

These radios pictured here; they could be using millimeter waves and millimeter waves basically is a high-capacity wireless technology. The millimeter refers to the fact that it is a very short wavelength wave and that allows it to carry a lot of information. However, it is limited in terms of other characteristics, like it won't go through trees, it won't go through building materials, it won't go through people. It kind of bounces off things for the most part. And so for anyone who's, again, older, or older than I am, the television we had we have television signals and radio signals for FM and AM stations go through our houses, they go through hills. In some cases, they can bounce around that is a kind of wireless technology that is very easy to work with. Millimeter wave don't bounce.

They just die when they hit something. And so that's a gross oversimplification that it's not technically correct, but conceptually it more or less explains what happens. And so millimeter wave have a nasty trade off and that they have an ability to send a lot of information. but they are more brittle, and they cannot you have to have clear line of sight is what I probably should have just said from the start line of sight means the two radios can see each other and hopefully you're not even going to get clouds really in between them. So another millimeter wave, 5G actually is a is a wireless standard for our phones and that can use millimeter waves. 5G can also use other waves, other wavelengths. And so it is the next generation of wireless service for our phones.

These are usually typically ten-year standards. So we are still transitioning from 4G to 5G and we will see that transition continue to play out for the next five to 10 years. 5G has a lot of technical improvements. There's been a lot of hype around it and what could, what could come of it. A lot of that is hype and it's frankly worth ignoring. The thing to understand it, you have someone coming to your building and telling you that they could do 5G for your residents you want to ask questions about how much it's going to cost residents because you want to have a connection that, in my mind in different circumstances, may vary but you probably want to have a connection that would be on the order of $10 a month, $20 a month, maybe per household for

people that are in difficult circumstances because we don't want it to be a barrier to get on the Internet.

You may want to have free wireless, free Wi-Fi wireless in public areas and in the hallways. 5G is generally going to be a service from like a T-Mobile and AT&T, a Verizon or another carrier and they're going to be looking to try to maximize revenues on it or at the very least charging people and that sort of a thing. And I get nervous whenever I hear the idea that we should replace free Wi-Fi with 5G, even if the 5G would be a higher quality service, which is will depend on local factors, the question is always what is the cost implication for the residents?

And I feel like Wi-Fi is a very high-quality product when done correctly, and we should probably continue to do that and making it available at either no cost or as low a cost as possible to make sure people are able to use it within the building. So if Ricardo wants to me to clarify that further, I'd be happy to, but that's kind of my first thought on that question.

Annelieske: Thanks, Christopher. Discussion around affordability is a great lead into the question that we have from Jessie. She asks, "Which is the best option for avoiding monthly costs for residents? It seems like the only option is a public fiber network, which is difficult for suburban cars like theirs that serve multiple jurisdictions."

Christopher Mitchell: Yes, I that is correct. If fiber optics were easy and low cost, we wouldn't be having this. We would just have all been done by now this is difficult for many. So I think the fiber optic is generally considered the gold standard because of the high capacity of the fact it will be available for a very long time, which is to say that the technical standards that haven't even been created yet will likely make it so that in 2035.

We're still using that fiber optic cable and it's just delivering even higher capacity than we would have expected even today. So fiber optics is great from that point of view. And the other piece of it is that fiber optics has a very low operating cost. It has a high one time install costs or a high capital cost. And once it's there again and then someone puts a backhoe through it or something along those lines, it very rarely breaks. And so when you're trying to figure out, am I going to how do I tell the difference between is fiber going to be a better deal for me or is wireless?

If you're going to try and think about those costs over three years, almost every wireless solution will look preferable. And if you're going to do it over 20 years, almost. Every fiber optic solution will look preferable because wireless gear is typically on a lifecycle of three to five years, which means over 20 years. You might be replacing it four or five, six times. And that's going to be costly. And some of that's going to happen during the recession or some other inconvenient time. And so and so the just you have to be aware of that difference of when you decide the time factor on which to consider your costs is going to significantly sway the answer between fiber optics and wireless.

Now, with that being said, fixed wireless is often going to have lower operating costs than mobile wireless for a variety of reasons that have to do with just the complexity of the radios, I guess. And that's sort of a thing. So there's a variety of factors to consider. But the question is

ultimately, if we want people to be connected at the lowest possible cost, especially right now, with so much state and federal funds around.

Here in Minnesota, we've got a $9 billion surplus. And I really wish we could just earmark a small chunk of that for permanently solving public housing challenges for Internet access, because we're talking about tens of millions of dollars, the like solve it for the vast majority of public housing residents of one-time cost to just get it done for decades. We want to figure out how to make these investments in a way that will drive the lowest possible operating costs so that the public housing authorities or other building owners will be able to continue to provide the service at low or no cost. And we'll be talking about some of the economics of this in the next example.

Annelieske: Thanks, Christopher.

Christopher Mitchell: Oh, and I see ALO fiber came up in the chat and I say, like, you have to understand, like a company like ALO, these regional and local companies, they maybe they're going to have a different partnership conversation with you than with a major national company. And that's not to say that the national companies are bad.

They operate under different circumstances. And even within the company like ALO fiber, you might have a salesperson in your region that has a different take on it than a different region. And it can be really worthwhile talking to those companies to get a sense of what they may offer but if you're feeling technically intimidated, that's where organizations like Shelby, The School, Hospital, Library, Broadband Coalition or DIA can be really helpful to meet other people who are working on similar challenges.

Annelieske: Thanks, Christopher. That's a great reminder. So at this point, I want to make sure that we have time to get through the community examples that you have for us. We do have a ton of questions still to get through so we can take those at the end when we come back to our Q&A. And just as a reminder to everyone, please continue submitting questions to the Q&A. It's easiest if you put them into the Q&A, not the chat. That's where we'll be able to see them. So please just keep submitting them and then we will return to Q&A at the end. Thanks, everyone.

Christopher Mitchell: Great. Thank you, Angelica. All right, community examples. Let's see how my memory is doing. So this is an example that we wrote up in depth because I feel like it offered a tremendous sense of the economics and various technologies. So a lot of what I've actually talked about is, was discussed in this paper, perhaps in a in a more clear manner. San Francisco, as I understand it, is has moved on a little bit.

They might be using different models now. So think of this as a snapshot in time. San Francisco, I think, has been some of the people within the large various stakeholder parts of the local government have been deeply involved in this in ways that we'd love to see other people and other organizations copy. But San Francisco worked with local provider called Monkey Brains. Which I always feel a little bit defensive about. They are a serious company. They have a 20-year track record of delivering a high-quality wireless service in San Francisco using fixed wireless. They also use fiber optics, but they are an ISP that, that is very strongly believes in the

public good. And they were open with us and able to share a lot of the things they were doing as well as their goals. And so we wrote about their partnership with San Francisco.

San Francisco has substantial fiber around the city that is owned by the city and county of San Francisco, and Monkey Brains wanted to find ways of helping to connect low-income households in public housing. And so they worked and in fact, it was part of it's been long enough now that I've forgotten the name of the program, but it was that program where you take public housing. The substantial renovation, and then I believe it is privatized to a nonprofit corporation. And I can't remember the name of that program.

DeAnne Cuellar: Hope Six. I think it was Hope Six.

Christopher Mitchell: That's not what I was thinking of. It was RAD something I thought.

DeAnne Cuellar: Oh, yeah, RAD. Yeah. That's still exists. Yeah.

Christopher Mitchell: In hopes this might be what they have been doing more recently at this time. It was part of the RAD program; I believe. And so what they did was they were able to get in there and in some places, they were able to use they were able to do a change order early enough in the process that they did get Ethernet cables to each unit. And in those areas, they were able to deliver to residents a gigabit connection to each premise with, I believe, a $10 a month charge, which the households themselves did not pay, but the building or the building loan or a property manager was paying on their behalf.

And this is a sustainable cost for them, in part because they I think I think 15 or $20 a month would have been more sustainable for them, but in part because they wanted to prove that you could do it at this low cost, they did donate some of the electronics gear that's required switches for in the building in some cases. And so I feel like it was $10 a month here. It's possible that for others would be on the order of 15 or $20 a month. And in here we talk a little bit about what those costs mean. But again, let me break it down.

We have the challenge of getting the building connected to the larger Internet, and that is in this case, done either by a fiber from the city in some cases because they had fiber nearby or by a rooftop wireless connection. And that is something that Monkey Brains is able to do because they have hundreds of those scattered throughout San Francisco. So they get that high quality connection to the rooftop and then they use Ethernet to distribute that signal within the building. I'm sorry I said that wrong, but wireless to the rooftop or fiber to the basement and then that's distributed within the building by Ethernet. They the one-time costs are on the order of like I said, I was in the hundreds of dollar low, hundreds of dollars per unit of one-time costs.

And then because they get the why they do the wiring, the cost of them to deliver that service are on the order of $10 a month per unit. That's because they don't really have to do anything for an Internet service provider. The cost of providing the bandwidth to you is very low. It's a very small part of the cost of running the network for Comcast, it might be cents for because they do so much of it, it might literally be a few cents. It might even be less than that per person when it

comes to bandwidth, when it comes to a small ISP like Monkey Brains, it's still well, less than a dollar, and it might even be ten or $0.25 per customer per month for bandwidth costs.

What really costs money is building the infrastructure. So if I go out and build a network, I'm going to be having to pay operating costs to keep the network operating. But my single largest monthly cost is paying off the cost of building the network because I'm not a trust fund kid. So I would have had to borrow money to build the network and I have to pay those lenders back over some period of time. Every month I'm making a payment to them. And so that is the single greatest cost I have in running my network. The next greatest cost is the people that run my network.

And so here it would be more costly if you set up if you're Fresno for instance, and you're adventurous and you have a very large base of people that you're serving, maybe you want to set up your own ISP to operate it in most cases, the Public Housing Authority probably does not want to do that because it's going to be so costly unless they have tens of thousands of people that they are connecting. And ISP like Monkey Brain has more than 10,000 users, other Internet service providers. So they're already paying for people to answer the phones. They're paying for people to do their taxes, the taxes of the ISP they're keeping track. They have a system for management.

They have people that are going out and doing installs and fixing things. Those people are the second biggest costs of the network. And so what that means is that if you want to deliver an affordable cost, as we got that question about a suburban public housing authority that means; A) picking a technology that will make sure the recurring costs are low. And then also, how do you have as few people dedicated to doing the work as possible, which is to say helpdesk often as a we term that. When something goes wrong with this network, who's the first people that are called by the household?

Is it going to be someone on your staff at the Public Housing Authority? Is it going to be your partner, that might be a private company that is providing service? Is it a local organization that is working on the digital divide? It may be the library or something along those lines. This is where the infrastructure really bleeds into the digital equity solution more largely and I believe the way to have to we have to deal with that is in part the way San Francisco has is by having local organizations and a digital equity coalition that are helping to take that stress off of the people that are responsible for keeping the network running. Right?

The people who are making sure that the network doesn't break and that are resolving technical challenges, they may not be the best ones to be providing the help desk functions and help desk functions are one of the most costly parts of keeping that network alive, if that's included in that. So if you can outsource that to a local group that specializes in it, it might be getting funding through the Digital Equity Act or through local government that recognizes the value of this and properly funds it. That's the way you want to deal with it. So we talk about the economics here in the San Francisco example, but understand that rents, say, $10 a month for gigabit service to the unit. They believe they can do that more or less until the heat death of the universe, because the costs are so low technically. And in this case, they're actually answering the phones as well.

They treat, they treat every person in the public and the public housing authority as though they were a different customer which is a weird way to say it. If a public housing customer calls, the person answering the phone doesn't know that. They just see them as a as a customer of Monkey Brain. So Monkey Brains has figured out how to do this at a very low cost. Others may not be as efficient and good at it, so their cost might be a little bit higher. But still, it's not impossible to imagine ten, 15, $20 a month, which is well below the ACP. And that's as long as we have the ACP. It's not as important. But like I said before, the ACP might disappear.

We have to be as efficient as possible to make sure that it runs so the lesson of the public housing in San Francisco is upfront. Make sure you get the technology right to drive those operating costs low. The way you generally get the technology right is by relying on Ethernet wires into the home. In the case of one of the RAD developments, which I believe is Hunter's Point in San Francisco, I think Hunter's Point was one where they had they were unable to change the wiring, but the wiring that was run for telephones was a cat five e-cable. And so they were able to basically stop the technical. But the Cat five e-cabling for telephones was nice because the telephone doesn't require all of the wires within that cable. And they were able to rewire things so that they were able to deliver 100 megabits to people there.

So that was terrific. So that San Francisco, we can come back to that in the Q&A as well in Monkey Brains. The other example is the Y zone and in Yonkers, which is using CBRS. I just reacquainted myself with this interview that we did three or four months ago, and I and I have to say, this interview is terrific. I mean, the two people that I that were on this interview with me both really brought a lot of lessons. If you never listen to podcasts before, this is a great one to start. And you can if you jump on a typical podcast client, if you listen to podcast regularly, you can go back 20 episodes from where we are today to listen to this. I think it's a terrific discussion about the technology and more importantly, not the technology.

This has all been about the technology, and I thought about this today as I was just rehearsing for this. Your biggest headaches aren't going to be the technology, for some of you, you might not be as technical, you might be thinking this is going to be difficult. The technology may be challenging, but your hardest part is going to be building trust and working with people to make sure they're able to use the connections that are available. Then we really talk about that in this interview here. But Y Zone has two CBRS towers. Each one, they end up connecting 250 families I believe. When I talk to them, I think they had 175 families on one of them. And it was working out well for their, what they were looking for.

They were delivering a connection that I think hovers around the basic definition of broadband. Which is to say on the order of 25 megabits down. If I had to guess, we didn't really, they didn't have the full numbers there. But as I was talking with them before and after I would assume it was on the order of 25 megabits down, 10-15 up. They said that they were not getting complaints from people, that it was too slow that people were really grateful and excited about it and using it. So that's an important test right there. But the install cost to build the towers was, I believe, $200,000. You amortize that across 250 families or so I believe. And you get that it's approaching $1000. Which is a lot. That's a cost for those towers. Some of that cost would have to be repaid after three or four years I mean, it would have to be rebuilt.

Not all of it. So it's not that you'd have to pay another $200,000 in five years to get to the next generation but you're going to have a significant cost down the road. The devices, I believe, are still in the order of several hundred dollars per family, on the order of 300 and $400 each. That might have dropped a little bit since, and it will drop more over time for those client-side devices I was talking about. The hockey pucks that people would take into their homes to use. But they are they're using it in areas where it is penetrating the building materials. And that's one of the issues is that you can have issues with the building.

The exterior of the building may not be hospitable to the signal, it might block enough of it, but it's not very good on the inside. And I think I want to make sure there's time for Q&A and we can answer people's specific questions about this. But why is it the most important part is just how good they've been about educating people, developing the digital skills, making sure people are confident and able to use it well. That is hard work and requires local partnerships with trusted organizations that are already working in these communities. And the thing is about the technology that you have to keep in mind is you might think we want to do this in a building.

It's difficult to do just in one building as I understand it. It's more of that like you would have in a building which you would broadcast away from, and that would cover on the order of half a mile to three quarter of a mile out in all directions from the building. The building itself would not be well covered. And so that's because there's an umbrella effect, because the wireless is going away from the building. If you just want to have one building, you want to be on nearby buildings broadcasting into it, but that may not be cost effective. So this is where you want to talk to a technical consultant about this kind of thing. But this is a solution, the CBRS is a solution more for small neighborhood or buildings within a neighborhood, and not so much for just targeting one large building.

You're targeting one large building, you probably really want to focus on that Ethernet type of approach. So that's that interview here is terrific. I think there's others who have been talking about why there's been a number of articles about it. I'll end by saying that in a different world I would be talking about how great Tucson CBRS was. Tucson went about trying to build an aggressive network and actually, I think they did technically well. But last time I checked, there had not been very many people using it. And I think it's because of what I said the biggest challenge is getting people to trust the system.

A lot of people who are not on the Internet, people who have limited incomes, are deeply distrustful of companies that might serve them. They are distrustful of government. They might be distrustful of different government agencies at different levels. But it is not the case that merely building a network is going to get all the people connected. There are a lot of people for whom there's a lot of additional work, and that is where I think most of you will find the greatest challenge to succeeding and making sure people can benefit from Internet access and help them to be able to then use it effectively to improve their quality of life.

So with that, I think we should dive back into the questions and answers. But let me let me ask you the first question might be for me to ask Dine if you want to supplement anything that I said or any additional thoughts I didn't cover.

DeAnne Cuellar: I can honestly say you covered everything. Chris and I have nothing to add.

Christopher Mitchell: All right, then. Other questions that we have.

Annelieske: Thanks, Christopher, and thanks for sharing these examples. I think it's helpful to see them. These technical solutions you were talking about really grounded in how it can be applied. So we have a few questions, and I would encourage everyone to keep submitting them to the Q&A and we will get through as many questions as we can. So this first one is from Terry Hansen. And they ask, "Which would be better a Wi-Fi system for an entire building or using the existing coaxial cable that is 25 to 40 years old?"

Christopher Mitchell: So there's a there's actually a got you in there, which is a question of whether you have sole ownership of the coaxial cable. This is something that we've come upon before which is a question of if a cable company wired the building and you can actually put in the chat if this is not relevant to you, frozen might be relevant. And they have some customers who are using it. Is it possible for a different entity like the Public Housing Authority themselves to use that same cable system to deliver Internet access to other families who are in the building?

And my sense is no. That the cable company and the cable technology and the cable company's preferences would be that no one else use that. So the first key question is who owns the wiring? And that wiring may be owned by a cable company that put it in. They may or may not be interested in continuing to be the ones in control of it. If you have cable that largely works within the building, which is to say that this stuff can degrade over that time period, but you could have someone that would come in and be able to test it for you and to give you a sense of how high quality still is.

You can do a lot with a cable plant in a building, in a captive building like that. So I this is this is admittedly more technical than I would say. This is I would say you should get a second opinion from someone who knows more. But I would say that I would lean toward that cable system if you have sole control of it. Because I think you can deliver a high quality product and that's every unit. Whereas I just have deep doubts about the ability of Wi-Fi to get to every household the way that you would want it to.

Annelieske: Thank you Christopher. Another question again from Ricardo is "Do you have any examples of white space spectrum technology, such as Microsoft's urban initiative being used successfully in urban areas?"

Christopher Mitchell: I do not. I would not surprise me if there are a few examples of that. This technology relies on areas where you have the television spectrum that is not being used currently. And in most urban and suburban areas, my understanding is that spectrum is more or less largely used. So I don't I can't name an example of that off the top of my head in an urban area. Even in rural areas, I certainly checked in on this and I feel like it is still a technology where there is a hope that it will continue to improve. But right now, it's delivering speeds that are not considered broadband or a barely considered broadband. And so I have not considered that to be a technology that I would be encouraging people to rush out and jump into absent

further investigation. I think it is good for what it is in reaching areas that are very challenging with basically minimal effort, but I'm not sure that it is going to be very useful in urban areas.

Annelieske: Thanks, Christopher. We have two questions that are related to fixed wireless, so I'm going to pose both of them to you. The first is "If a fixed wireless system could be powered with solar power?" And then in a related question, "What would be the space demand for a fixed wireless infrastructure on a rooftop?"

Christopher Mitchell: Those are good. There are examples of fixed wireless being deployed entirely by solar and then batteries, battery packs. Close friend of mine that I work with regularly, Matt Rantanen has been running the Tribal Digital Village, which connects 16 Native reservations in San Diego County. They are largely connected by fixed wireless sites on top of ridges that have no, in some cases have no electricity from the grid. And so it is possible to do that. It is difficult.

You typically have to have a multi-day battery kind of supply, which would take up a lot of space, although it's a heck of a lot easier now than it was 20 years ago. So but you can certainly you can certainly do that. The question in my mind is, after you price that out, what is there a way to have an electrician run a connection up there that would be lower cost in that over some time of years. But that's something the local person would be able to figure out. There are definitely a number of places that do that, and in some cases they supplement it with they'll have grid electricity, but I'll have a backup with a solar power as well. The other question was, can you remind me what it was? Annelieske?

Annelieske: The second question was "What would be the space demand for wireless?"

Christopher Mitchell: Yeah, I think it can be pretty minimal. I mean, that photo that I have there sure, yeah. All right. I was going to do a final point there. Where's the picture? Picture is back here. That's those are pretty small. You probably don't need much bigger than that for that tripod. I'd say that's on the order of like three foot by three foot, maybe four or five foot by five foot. And then you that'll be running to some place. You need to have someplace were you have shelter and power that might be in the building.

It might be a little hut on top of the building, depending on different circumstances. But you could even have a mast that was not fastened to the roof. But if you did have a structure on top of the roof already you could structure it there. You would basically be able to attach the mast to that building top typically use a tripod in a situation like this because you never, ever drill into the roof. Because that voids warranties and things like that. So it would depend on where you can attach as to how much space you would require on the roof.

Annelieske: Thanks, Christopher. We have just one question left, and that is, "How can you structure the hard-wired fiber optic infrastructure plan? What has been your experience in coordinating amongst all the wireless carriers?"

Christopher Mitchell: Sorry. Can your redo that real quick.

Annelieske: Yeah, it's actually I was submitted to the chat, so let me repeat it. But "How can you structure a hard-wired fiber optic infrastructure plan?" is the first question. And they seem to be specifically wondering about how you can coordinate among various wireless carriers?

Christopher Mitchell: The coordination among various wireless providers, I think is it really varies tremendously as to who they are. When you say wireless, that could be T-Mobile. And they'll have a different approach to two guys in a truck that have 50 customers. And so it will really depend on that group. Local ISP's will range significantly from those who have deep anti-government animus to those who are just trying to figure out how to serve their community as best they can. And frankly, some of those may have both people that are really trying to serve the community, have deep government entities.

So there's a wide range of people who you might be dealing with. And I think the thing to understand is that the wireless business is one that can often appear to more entrepreneurial types, people who aren't able to get $10 million loans from the bank to build fiber optics. And I think you kind of have to meet them to understand what their motivations are. In some cases you might say, "Well, that was a waste of my time and I never want to talk to that person again." And in other cases, you'll have a partner for life. And it can be hard to tell absent having a coffee with them or in a technical world, we often talk about grabbing a beer with someone, but I guess you'd have to do that in off hours because many of you are under a more of a magnifying glass than people I'm often working with. So regarding public housing authorities, I will say candidly, I don't have a good enough answer to this.

This is one that I feel like if you're able to reach out to people in the National Digital Inclusion Alliance email list. Some of the folks who work from public housing or often with public housing there would probably have a good sense of how to develop this. I would look at San Antonio's public housing has been aggressive in the past on seeking grants to help pay for connections to households. Dina may have a sense of anything there, but Cleveland's Public Housing Authority has also been working with a group called Digital See. The New York City Housing Authority now has a new deal, but they've tried different things. They just struck a deal with the cable incumbents, I believe. And then Fresno, Bobby Colter, I think is his name there. I'm just I just think of him as Bobby.

DeAnne Cuellar: That's Bobby. Yes, that's him.

Christopher Mitchell: Bobby, the guy who loves the storefronts like I do. So he you know he's someone has given this a lot of thought over the years. And if I'm at an event with him, I always want to try and pick his brain a bit. And I think others would be wise to do that as well.

DeAnne Cuellar: I would add that people who are working with public housing residents are also looking at hybrid models, meaning that while they're building the solution, their long-standing solution, they're looking at temporary options. So there are there are still programs at this phase in the pandemic that are still using hotspots. They're still using tablets that are connected to the Internet. But those are temporary solutions while the resilient one is being constructed.

Christopher Mitchell: And I did make these points, even though I think that's fine. But this is going to be the hardest part. And Dina and I are definitely available for further discussion. We're very easy to find, and I think a lot of the other people who have done this work are very happy to share their knowledge on it.

Annelieske: Well, Christopher, thank you so much. And DeAnne you as well. We are just a couple of minutes past our scheduled time for this live webinar, so I'm going to pass it over to Dina for some final remarks. But thank you to all of the attendees for joining us today.

Dina Lehman-Kim: Yes. Just one a second, Annelieske. Thank you to Christopher and Diane and also to all of the attendees for asking such great questions. Clearly, this was a needed presentation. If you have other thoughts about what topics you'd like us to provide training on, please send us an email at Connect Home at hud.gov. I'll put it in the chat. Otherwise, please register for our summit coming up October 25th to the 27th, and we will be covering the new broadband funding BEED and DEA as well as ACP. We'll be having federal agencies on hand to talk about those programs, and we will have much more. Registration is live. You can go to our HUD exchange page for that. And with that, thank you so much, everyone, for joining us today. And thanks to the ICF team as well.

Christopher Mitchell: Thank you, everyone.

(END)