NWX-DOC-NTIA-OTIA

Moderator: Jean Rice
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1:00 pm CT

Coordinator: Excuse me. I'd like to inform all participants at this time that the conference is now being recorded. If you have any objections please disconnect at this time. I'd like to turn the call over to Jean Rice. You may begin.

Jean Rice: Thank you and good afternoon. I'm Jean Rice and I'm with the National Telecommunication and Information Administration's Broadband USA Program.

I'd like to welcome you to our Broadband Conversations webinar. Today we're talking about best practices for enhancing deployment of public Wi-Fi network. As many of you know public Wi-Fi can help reduce the digital divide, be a part of a smart cities plan and provide the backbone infrastructure for the Internet of Things or IoT which marry technology and data analysis.

Today we're going to be talking about some of the deployments in Schenectady and in San Leandro, California but I want to start with a story about how public Wi-Fi was used in a rural area.

It has helped with the digital divide and IoT for the Ute Tribe of Utah. They implemented public Wi-Fi three years ago and are located deep within Utah right next to Dinosaur National Park. When they went to test the first public Wi-Fi antenna they didn't even have a service up there, just testing the antenna. They were shocked to see 20 cars show up.

Word of mouth had spread and parents were bringing their kids to do their homework. This just shows how much it was needed. In addition to those kind of applications that people use they're now using it for IoT, for public safety, tribal government communication and health, next slide please.

Here at NTIA, we have, you know, were really pleased over the last year and years before that to collaborate with NIST, our sister agency at the Department of Commerce on the Global Cities Team Challenge. And as part of that the public Wi-Fi now wireless super cluster which is a program that brings together cities, communities, universities, and industry can work on smart cities projects geared to people-centric solutions that are replicable, scalable and inter-operable.

As part of the super cluster for public Wi-Fi we look at how cities use public Wi-Fi and found this includes economic development, promoting tourism, providing IoT infrastructure, increasing digital inclusion, workforce development and more. As part of this super cluster we developed a public Wi-Fi blueprint that provides best practices in consideration on all aspects of public Wi-Fi deployment.

The link to this blueprint is on this slide and I encourage you to use it as a resource. Now throughout this I have to say that my – the three co-presenters that worked with me on this leadership team of the super cluster and they have done a terrific job. And so you'll be hearing a lot of the results of their own

projects and of what they've learned through the analysis of what other cities are doing and what communities are doing in public Wi-Fi.

We have a terrific line of speakers today. We have Mayor Gary McCarthy, the City of Schenectady in New York. He's a champion of a smart city --- and nationally. We have Tony Batalla, Head of Information Technology for the City of Leandro, California. He's implemented public Wi-Fi and other smart city projects and is working on regional public Wi-Fi collaborations in Silicon Valley. We've got Steve Wimsatt who's the Senior Director of Business Development and Alliances Ruckus Networks who's working with cities around the country deploying public Wi-Fi. So you've got a great experienced group, next slide.

And I just wanted to make sure as you go forward on public Wi-Fi both of us on the panel and others at Broadband USA would be able to help you and we also have toolkits and workshops that also – you might find interest, next slide.

We do have some bit of information to give you here. We're going to have questions from the people who are on the webinar at the end. So we're going to use the question box so type in your questions. Definitely type them in when they come up. You don't have to wait until the end and we'll go through them at the end of their presentation.

Just want to let you know that the transcript and of this and the recording will be available on the Broadband USA website within about seven days. It will be under Events BBUSA webinar archive, next.

Our 1st presenter is Mayor Gary McCarthy, City of Schenectady. He's held that position since April of 2011 and brings with him more than three decades

of experience and government and reputation as a hands-on accessible public servant who believes that government can be a force for positive change in the lives of its residents.

In 2016 Mayor McCarthy appointed mayoral smart city commission to take advantage of new technology for superior delivery of government services and improved quality of life. In 2017 the city of Schenectady deployed its 1st phases of public Wi-Fi downtown and has partnered with the National Grid to deploy a citywide smart city demonstration project over – as a way to convert national grid existing street lighting system into an advanced LED street lighting platform for smart city technology and services.

The city is working with numerous partners such as AT&T, GE, Intel, Cisco and more and the smart multi partner effort is designed to allow for flexibility, cost, effectiveness and scalability throughout the city. So Gary tell us what's going on in Schenectady.

Mayor McCarthy: Jean thank you for that introduction, go to the next slide. Schenectady is a full industrial city that Thomas Edison came here 125 years ago and formed a general electric corporation and the birthplace of a lot of innovation, creativity and talented individuals. Go to the next slide.

We currently have about 140 smart lights installed in Schenectady under really three separate projects with 16 Wi-Fi access points. In the next few weeks we'll add another 160 smart lights with the other 23 Wi-Fi access points. This is really just the cornerstone for what will be a full citywide deployment. Go to the next slide.

We're looking at using it to integrate our street lighting, our smart parking, video surveillance traffic analytics, common platforms that support different

services, remote and connected learning, looking at light safety features with some of the emerging wireless and sensor based technology, of course using it for the delivery of city services and then also medical applications. Go to the next slide.

We're doing this in partnership with the National Grid which is our local utility company. Historically many cities have maintained networks of communication along city streets which interconnect to buildings and devices. It's just great to have a utility that wants to maintain that relationship and grow. I want to go to the next slide.

In New York State there's a program that was put forth by Governor Cuomo. It's called the REV project, Reforming the Energy Vision. It set the stage for New York's energy future that connects a vibrant private sector market with communities and individual customers to create a dynamic in clean energy economy.

Governor's Cuomo's vision has resulted in a plan to work together to make a strategy for clean, resilient and more affordable energy systems a reality while actively spring energy innovation and bringing new investments through the state and our communities across New York. I want to go to the next slide.

Over the past year we've been working with National Grid on this proposal and it's currently under review with our Public Service Commission. And once that final approval is given that we'll start a citywide deployment where we'll replace the street lights with LED lights but at the same time put the sensor based technology on the light head and light poles which will include Wi-Fi and cellular communication. There'll probably also be a low pan system that will be used by National Grid. Go to the next slide.

If you do anything today one of the things you have to be cognizant of are the high security requirements that not only utilities have but we as municipalities. We're under constant attack with individuals and now even have foreign countries that are trying to compromise our data. We look at, you know, police and fire data, our traffic signal, street lightning, power distribution system, billing systems. It's just a few components that you have to be very cognizant and look to maintain high levels of security.

I want to go to the next slide. We have a broad base of partners. Jean outlined some of this where working we're with National Grid. We're working with GE, Cisco, AT&T. The Alliance for Better Health is a local – it's actually a regional organization dealing with the better delivery of medical service Ellis Medicine.

As you look at the technology and innovation that's out there you can't just – I don't believe approach it on the narrow target of just one customer. You have to look at a broad based engagement to utilize all the emerging technology and the whole implication of the Internet of Things. You can go to the next slide.

Having a platform where all of the resulting data can be reviewed in one dashboard is one of the more important objectives of this project. The need exist to have all the data in again one dashboard with the elements we need to perform our duties of our job and then be able to exchange with other community participants so that they can derive the maximum value for this type of deployment, the next slide.

Look at promoting tourism, supporting the local businesses in fostering a public private partnership we've been working with a local company. Transfinder did an application called city finder to allow us to track down

where we have a trolley that goes through our community at the same time promoting local restaurants and businesses. Go to the next page.

Again we have just some of the examples of promoting local businesses, supporting tourism. You can do promotions with bars, restaurants, other retail establishments, the element of public safety, making sure that our police and fire are able to respond and deal with the information. I want to go to the next slide.

I have a little animation here for…I have building fire. A sensor goes off to the network. The fire department shows up, puts it out. They're back to the station in no time and everybody's happy. One of the key things that we've done with our initial deployment is the ability to upload in-car video from our police cars. We do that through an access ID separate secured channel.

We used to have to bring the car in, take it out of service, unload the data. Now with the network that's in place the cars are able to download that video while they're just waiting for a traffic light to cycle. Go to the next slide.

Parking and traffic analytics are key in urban areas managing parking spaces, fine tuning the timing on traffic control devices to improve traffic flow. It increases user friendliness of people coming into a community, reduces greenhouse emissions and of course saves time. It also will help in the planning process by getting vehicle counts – speed counts and other management information that sometimes make a difference in terms of where businesses locate. Go to the next slide.

We've assessed that our savings --- for just energy cost converting the LED lights. It'll be about $375,000 a year but there are a number of technologies where you deploy and there's going to be different savings in improved

efficiency. So we're again looking to have this integrated full deployment across the city that will improve our delivery municipal services, improve public safety and just make the community more attractive. Go to the next slide.

Again one of the big components in urban areas, we have some fairly affluent neighborhoods. We also have some areas of poverty within the community and making sure that students have the access and environment to allow learning so that we improve our graduation rate and make sure that kids are given all the opportunities that are available to them and the Wi-Fi and this network will allow that. Just our last slide, just a picture of City Hall and I'll turn it back to you Jean.

Jean Rice: Thank you Mayor. I have to say I love the animation because it really shows how public Wi-Fi which most of us think of it as a way to get to the Internet for homework or for other uses but how it's used as the backbone for IoT for your police and fire. But tell me when you first started looking at public Wi-Fi what was the principal reason that you moved forward on it?

Mayor McCarthy: We were looking at economic development bringing people and just Internet access to the community. And then clearly the public safety component of it, improving our efficiencies with the management of our police force where they're very expensive personnel. And so if we can keep them on the street and responding to calls it helps everybody and it just – again that balanced approach. It's not only public safety but it's the community as a whole and fostering that environment that creates economic development opportunities.

Jean Rice: Great, thanks. I know that public safety and economic development is usually a high priority for most cities and communities so thank you. Our next speaker is Tony Batalla. He's the Head of Information Technology for the

City of San Leandro, California and he also is the co-Chair and one of the guiding forces of the Global Cities Team Challenge while a super cluster. Since the deployment in San Leandro in 2014 he's helped launch a 10 gigabit Internet connection that City Hall and three public Wi-Fi systems using city's fiber optic networks.

He oversees all aspects of the technology including infrastructure, service delivery, data management. So he has a great depth of information and has worked through a lot of the common problems that people go for. I'm happy to have him here talking about best practices. I also wanted to mention that he acts as a Senior Advisor for his city council on technology issues and policies. So Tony, please tell us a little bit about what you've been doing.

Tony Batalla: All right. Well thanks Jean. I am the Head of IT for the City of San Leandro and we're just south of Oakland in the Bay Area, about 90,000 residents in our city. Next slide please.

So the first question, you know, is why build public Wi-Fi? Mayor McCarthy did a great job of outlining the use cases and for us it was a lot of the same. It was economic development to activate our downtown and revitalize our downtown as part of a larger project. But it's also a service for the public and it's a public good.

We look at it as the same way we do our roads and streets that we deploy broadband infrastructure as a service for the residents here, next slide please.

So I want to take you through a little story about how it came to be. This was in 2014 when I first got here and there was this huge development project going on in the downtown. This was really the centerpiece of the

revitalization project. This was a parking lot, what you see on the screen for many years.

And a developer came along and had this really big vision to turn it into what he called The Village. This is the after picture that you see. The open space there is the Habit Burger so there's a lot of people hang out there. There's some great business that you see but there are all these businesses signed on. There was Chipotle and the Habit Burger and Peet's Coffee which people were finally so excited that Peet's Coffee was going to be in San Leandro.

At the same time if you go to the next slide directly across the street was the historic downtown. This is a much different type of architecture. You can tell. This is 1950s style and it really hadn't had much development since then and that served as the core of the downtown for decades. But there were a lot of businesses there that were very popular, Los Pericos and Café Sole and lots of little places so this kind of merging of the old and the new, next slide please.

And so what we did was we recognized that that historic Pelton Plaza sign which is 52 feet high was the perfect place to serve as a gateway for our Wi-Fi network because it had great visibility everywhere we went. So what we did was we used that. We actually ran fiber right up to the sign. We lit it up and we built a mesh network using our decorative street light poles which you see in the upper right. And, you know, some of the specs have been – it was 802.11AC. It was a 1 gigabit connection because we had a 10 gig connection here at City Hall. We put a five year warranty on all the equipment to really maximize the life span of it, next slide please.

In the final design we were able to cover the Pelton downtown core. On the right side that's the brand new development The Village. We got all the

adjacent areas and we also got this core along the bottom which is where we have our farmers market. So that really served a lot of local businesses as well because now they could do their transactions on a secure Wi-Fi network. So this is owned and operated by the city. We funded it out of our general fund.

We used a partnership with Lift San Leandro which is a public/private partnership we have here. I haven't gone into detail on that but that's a whole separate project that we're very proud of here. But we use that network to service the backhaul and it really enabled us to light this up, next slide please.

The expansion since then, we've been able to go from the downtown core which is just the dot on the map there to our libraries, our civic centers. We've worked with the Boys and Girls club to light up their center. We've expanded to all the city facilities. We've got a secure network at the water pollution control plant that they use to connect into their equipment there and we have much more planned this year.

We're probably going to add another eight to ten sites this year of public parks and some other branch facilities. Next slide please. So the best practices and key takeaways -- and this is really the slide where I'm going to spend the most time -- that we found, I bucketed them into different groups but the 1st one is on design. I mentioned that we used a mesh network and that's pretty straightforward.

I think everybody is familiar with the concept of mesh network. But what I did find was that the mounting location and the access to your network are really the number 1 and number 2 most important things. Each site when you do outdoor Wi-Fi, again this is all about outdoor Wi-Fi. Indoor Wi-Fi is pretty straightforward but once you go outdoors there's all kinds of variables.

There's foliage and there's building height and there's construction and line of sight you need to have. So each site becomes its own little puzzle and you have to figure out. The things you're trying to solve for are the mounting location. Where am I going to put my gear and how do I have access to my network? Once all those two things, everything else is downhill from there. I actually don't know if downhill means it's good. Sometimes people say it's downhill and it's bad but in this case it's a good thing. It's all downhill once you solve those two things.

From a strategy standpoint what I found to be really successful is to think small. By that I mean you have a big vision that we're going to do this. We're going to serve residents and businesses and drive economic development and it's a lot of great things pushing it. But when you actually get out there in your city it's better to think small and pick an area that's really dense where you're going to – it's a for sure win if you can figure it out and build from there. That's what we did.

We picked just the downtown core and have now expanded and have a much bigger footprint. But that really helps us, you know, figure it out and fine tune it as you find technical problems. We need a bigger DACP server because there's too many people in the network. You can figure that all out with a small area and learn and improve as you continue your deployment rather than trying to do one big citywide in one shot. That's costly and it's going to be much more painful as you learn in such a larger project.

Another really key one that's used -- existing infrastructure -- as much as you can find city facilities, find buildings, find partnerships. We actually signed a partnership with the Pelton property owner that allowed us to use that sign in exchange for providing free Wi-Fi on their grounds. You have to be creative

and think outside of the box and approach people. When you find that great mounting location and it happens to be a business owner approach them with an offer. Hey we'll light the place up if you give us access to that. You really need to use as much infrastructure as possible because that's going to lower your cost.

It's all about keeping the cost manageable and using existing infrastructure and existing networks definitely help make that happen. You'll see now that I have this highlighted as partner with public works. When I say partner I really mean partner with them. Make sure they're involved in this project, that you have their buy-in, that they're on your team. And if public works people are on the call, then thank you. You're the ones that really make it happen. You know, if public works isn't onboard when it comes time to do your permitting and it comes time to do your encroachment permits and your parking plans because you're going to have to be out in the street hanging that gear on city street lights.

If they're not onboard you're making your life a lot harder than it has to be. You really got to work with them and figure out – each city is different. Some cities might really want to detail traffic management plan foreclosure. Other cities might be like okay, sure. No problem, that looks good to me. Go for it. But you got to partner with them to know that. You've got to talk to them. You've got to meet with them. Tell them here's what I'm trying to do and here's why and here are the benefits.

Be willing to, you know, understand their processes and procedures and their rationale in order to reach that goal. You got to be flexible because ultimately public works, they hold the key. So that's, you know, along with this understand your city process. It goes for procurement too.

You got to know how your city works and partner with all these different departments and really make it a cross-functional team. Public Wi-Fi isn't just an IT project or isn't just a city manager or mayor. It really takes everybody working together. It helps to have that one champion who has a vision as Mayor McCarthy did in Schenectady and as our city council did here in San Leandro. We certainly had the city council's blessing but when it came down to the nitty gritty you need to have those people working with you.

On a management standpoint I find managed services to be effective. We originally did all the troubleshooting and work on our own and IT staff was spending a lot of time like I said working on the DACP server. But after a while I worked with a partner, an outside partner and they took over and now they provide it as a managed service. So we just pay an annual service contract and all the support, all the troubleshooting, all the technical work is done by them.

They work very closely with my staff but ultimately it's an outside firm who manages the system. We found that to be much better use of my staff's time. A policy, you might not think about policy at first. It's Wi-Fi. Why does it matter? But you're collecting data, people are going on the internet. Kids are going on the Internet. Do you want to put content filtering on there? Are you going to make them sign an end-user license agreement that waives liability if something happens to them? What if they get hacked on your network?

What do you do with the data that you collect or you…are you going to turn around and monetize that data? If you do you have to get their agreement. Are you going to use it for law enforcement or tracking if someone asks hey, who was on there at this time? I want the MAC address.

These are all things that a policy should be in place for. You don't want to just be winging it. The last one is don't overlook marketing. Cities are really good at running cities but maybe not necessarily the best at marketing. When I say marketing I mean really doing that type of concerted ongoing sustained outreach to get people to use the network and know about the network.

I can't tell you how many times I've been outside downtown and I'll just go, you know, talk to someone, sit and have lunch and say, "Hey, you know we have free Wi-Fi out here?" And they're like "No, no. I didn't." I said, "Yes. The city has great Wi-Fi systems." They're like, "Thanks for telling me. If I had known that I'd be here every day." Students tell me that a lot.

I find it with students – the high school students, they have no idea. They don't pay attention to press releases and all the standard things that we do when we do outreach. They don't know what a city press release is. But if you can hit them on Facebook, if you can hit them on Instagram with good campaigns that, you know, can have a chance to get shared and get a lot of views suddenly you can reach them.

So that's what I mean marketing. I mean putting stickers out around and putting up free Wi-Fi signs everywhere and getting businesses encouraged to put the decals in their windows and then doing social media and doing it sustained, over and over and over again to really encourage the use of that network. You can build this great network and spend all this time but if no one knows about it they're not going to use it. So those are what we found and we continue to learn every single day. I'm happy to be here and thanks for the opportunity Jean.

Jean Rice: Tony so glad you were there and I really appreciate you focusing on the best practices that you learned because we don't all want to reinvent the wheel.

Since you've been involved with San Leandro and now you're working on a regional level with public Wi-Fi and smart cities what do you think are going to be the top three future trends in public Wi-Fi?

Tony Batalla: Well that's a good question. I think the 1st one is security. You know, deploying a public network you really don't have much – many options for securing the network. You can't put a password on it because how are you going to tell everybody about the password? Once you've put the password on the wall then everyone knows what it is and it defeats the purpose.

So we have an open network right now and the more cyber security becomes something everyone's familiar with, everyone here is about the hacks all the time, privacy leaks, the more it's going to become important that us as owners and operators of these networks are providing that level of security that people need.

There's technology out there now. Hotspot 2.0 is an example of a secure experience on Wi-Fi that doesn't require a password. It's more of a profile that gets downloaded on to a phone when you connect to a network. The profile download experience could be a barrier of entry because some people will say what's this profile on my phone I don't know but it's really coming on us to educate people on the value of that secure network.

So I think a big future trend will not just be public Wi-Fi but secure public Wi-Fi. That's one. Number 2 is roaming. So when you introduce this ability to put a profile on a phone you allow the capability to roam from one Wi-Fi network to another. We're looking at doing a partnership as you mentioned with the county of San Mateo and possibly other Bay Area cities to create a Bay Area public Wi-Fi roaming network.

If you connect in San Jose and then when anywhere in the county of San Mateo you'd still be connected. We participated and shared like some sort of Cloud authentication that provided both the security and roaming capabilities. That's another one to enhance the value of these public networks. A third one which you also touched on is IoT.

Wi-Fi is going to be a backhaul for IoT. And so having that network out there makes the deployment of IoT that much easier because now you just can connect it and backhaul it on your Wi-Fi network and get the data to wherever it needs to be. So you eliminated any problems with your transport layer when you do your IoT deployments.

Those are three trends. There are others that technology's going to, you know, of course there's the NextGen of Wi-Fi, 802.11AX and then the potential to use 6 gigahertz instead of 5 gigahertz and of course that's going to increase and enhance it. But the top three are secure public Wi-Fi, roaming public Wi-Fi, and IoT backhaul.

Jean Rice: Thanks Tony, appreciate those insights. Our next speaker is Steve Wimsatt. He's the Senior Director of Business Development and Alliances at Ruckus Networks. He leads the smart and connected city initiative including go to market activities and eco-assisted partnerships with key partners providing street lights, digital kiosks, Internet of Things applications, IP video analytics and other city related solutions.

He is a member of the Global Cities Team Challenge Leadership team and has previously served on the Board of the Dynamic Spectrum Alliance working on regulatory and technological solutions for TD wide space 600 megahertz spectrum. He's been actively engaged in the public Wi-Fi market for nearly 20 years and also has a great deal of experience in those things with public-

private partnerships. Steve, I've asked you to take a little look at the technical considerations, so let me hand it over to you.

Steve Wimsatt: Great. Thank you, Jean and thank you, Tony and Gary. Those were great presentations. I've heard it before but I enjoy – I learn new things every time you go through it.

For those of you who don't know Ruckus Networks is a leading Wi-Fi provider for – both service providers and for outdoor use cases. In the last year or so we've really leveraged this position to focus on smart city opportunities by adding new capabilities, adding ecosystem solutions and that this morning we actually announced – we've added capability where our access points can be used – can be converted into IoT gateways.

You can deliver public Wi-Fi and have a platform for IoT all at the same infrastructure. In today's presentation, in the next ten minutes I'm going to review some of the technical considerations for deploying public Wi-Fi. And Jean referred to this earlier in the presentation. This is all based on the work of the Global City Team Challenge public Wi-Fi team.

You can see the link there. I highly – I strongly encourage you to look at this. There's a lot of useful information. It's about 70 pages. I'm just going to scratch the surface so hopefully you'll see some of value in it, next page please.

Before we really get into technology first thing and maybe an obvious point, we really have to have some – you have some sort of strategy and some plan in place. The blueprint talks about this. The more input you can get upfront the better. It's much less expensive. It's much more useful to get this feedback while you're in the planning stages versus when you're in the middle

of deploying something or trying to make a success as something that's already been deployed.

In terms of the decision there's a lot of things to think about from performance levels to whether it can offer varying tiers of service to try to make some money off of the higher levels, content filtering, which organizations will be involved. The only one I want to go through very quickly at this time is just the general infrastructure policies. I think it's very universal.

If your city or town doesn't already have this in place think about some basic policies such as --- policies or anytime you tear up a street or a sidewalk you put at least conduit so it's much easier and faster to come in later and add some fiber or communications infrastructure.

You have some standard pole attach rules so that both the city as well as private parties will be able to more speedily and cost effectively deploy telecomm networks and also just having an inventory of your assets so that you know what's out there and you can effectively tap into those various resources. There's a lot of this in the blueprint, next page please.

So I think Tony talked about this in his presentation as well. This is very simple, you know, breakdown of what are the key parts of a Wi-Fi network. It's access points, the backhaul and the management. The most unique aspect of a municipal or city Wi-Fi network is this challenge as Tony mentioned of having to mount these access points.

You don't always own the relevant real estate where you'd like to place the access points and it's typically not easy access to power and to backhaul network connectivity. So a key feature is that from a CAPEX perspective from the cost of deployment the deployment cost could easily be more than

the cost of the actual hardware that you're deploying. Things to consider is, you know, you're going to be trying to hang the access points on light posts as you can see in those pictures or underneath a decorative lamp.

Sometimes on the side of buildings which is good because there's – these are going to get fiber oftentimes. With these we've had some people – there's a picture there of an access point that's in a cable box. It's coming up out of the ground, cable vault, wherever you can put the access point where it delivers the RF to where it needs to go. That's great.

These access points should be IP67 rated so they hold up outside. Meshing is critical because it can greatly reduce your backhaul cost requirements and makes it easier to deploy so you don't need to run a fiber. Each and every AP and this is wireless backhaul. Internal antennas or a small fore back run of the AP can also be an important consideration, A, for aesthetic purposes. Most cities don't – they want this Wi-Fi to be as invisible as possible.

You can see in some of these pictures it's pretty visible especially on your busy downtown streets. You might want to minimize that and if you have an external antenna that can be another item that needs to be licensed for a pole attach to cause another fee. It slows down your deployment. From a backhaul perspective anytime you can use fiber we recommend that. It can be very expensive to deploy fiber if you don't already have it, in which case you can extend maybe from the nearest fiber node using Ethernet.

Another option that maybe you're not aware of is millimeter wave. This is well proven technology. It can deliver multiple gigabits through-put over short distances. It only goes up to 400, 500 meters but it's an alternative to tearing up the streets and laying fiber on millimeter wave connection and some are like the --- or a mimosa can be a great option. And obviously Wi-Fi

mesh, the Wi-Fi mesh, going mesh to three or four different ACs from a single route node. At that point you need a backhaul connection back to the network.

Finally the other consideration management and Tony talked about outsourcing this which is a great idea. The management function is really just keeping track of the network, identifying any issues, quickly resolving them, collecting reports and analytics. You can show the value of the network and it can be – you can outsource it or you can get a Cloud-based management service. You can run it yourself, pretty straightforward, next slide please.

Security is a big deal. As part of the GCTC super cluster we surveyed about 45 towns that had active public Wi-Fi networks. The vast majority, 90%+ had no security. It's just a wide open network. The reason for that was because we wanted to encourage usage. We didn't want to have any blockers that would cause people not to use their network.

The challenge is as more and more are using Wi-Fi as cities are using the Wi-Fi network as a platform for other services and as people are deploying Wi-Fi as a way to bridge the digital divide it's becoming more and more of an issue to leave those users wide open and exposed. It's a fairly easy way to hack into an open Wi-Fi network.

So at a very minimum we recommend 802.1X security. This is – everyone knows this is where you enter your user name and password. After you do that you have an encrypted connection so it's harder for anyone to pry on a session. Challenges and you have to remember user names and passwords. It's not a great user experience.

PKI certificates are traditionally the gold standard of security. You put a unique certificate on the device. It allows the network operator -- the city in this case -- to apply policies for different types of users or types of devices. You've got very good control. Historically this has been used by defense contractors and banks, people – the very significant security requirement and it's been viewed as complicated.

Today however there's a number of solutions on the market that can make it very easy to manage and deploy these PKI certificates. Unlike most forms of security when you deploy a PKI certificate not only do you get a fully end to end encrypted solution every time users are on the network but you actually streamline and improve their experience.

So there's a – it's a great opportunity to actually improve and increase usage on the network. Finally Tony talked about Hotspot 2.0 which is based on PKI certificate and also includes back end roaming arrangements between different networks. You've effectively expand the footprint the network. That's a great model.

The industry's been working on this for years. It's fully standardized. If you deploy new Wi-Fi networks make sure they're Hotspot 2.0 capable. This solution however isn't quite ready as your primary authentication use case today just because not all the end devices can support it. That's happening over time as people upgrade their phones. Next slide please.

I'm going to quickly talk about business models and every city's different. But if you try to summarize it we've been following the three buckets. City funded, where the city just says Wi-Fi is a basic core infrastructure. It's a service we need to deliver. It's a platform for our internal operations. We just have to write a check and do it. That's city funded.

Public-private partnership is where the city might work with a private entity that needs – that's willing to basically trade. Maybe a service provider wants access to deploy fiber or main street and the city would say, "We'll let you put in your fiber if you offer free public Wi-Fi in this neighborhood." That'd be an example of a public/private partnership. The value is that the city works with the private entity. The private entity will fund – handle most of the deployment cost, maybe the operating cost. The city gets a service and in return the private entity gets something that it needs.

The third model is a peer service provider model where for whatever reason a private entity, be it a service provider or wireless ISP, some other operator is going to look at their cost, they're paying for it. They control it. All three models are good. They do different things. If you have an opportunity, there's a service provider who wants to come in and put in a network that sounds great.

You get public Wi-Fi maybe for free. The challenge to that is the city will lose control. The service provider's going to want to put that network where it makes sense for their business model and not necessarily where the city wants it. And depending upon how you negotiate the city might not have access to that network for other use cases.

Public-private partnerships are a great model especially if you're a larger city, if you're a city where people are – need help from the city to deploy important networks. So if you can do public-private partnership, that's great. Otherwise, the model we see most often especially in small and midsize cities and towns is city funded.

There's not going to be a free lunch in every case. We do think there's great value proposition for Wi-Fi. There's an increasing number of these cases in a lot of ways that justify that expense, next slide please.

And finally – and this is a bit of a preview of what the public Wi-Fi or what the Global City Team Challenge wireless super cluster is going to work on this year. We've expanded from public Wi-Fi. Now it's just the wireless super cluster. This mostly is in recognition that IoT is becoming more and more important.

There's a lot of smart city use cases and these IoT solutions have different wireless requirements. The vast majority of them need very little bandwidth and instead what they really need are very low power requirements. They need to be battery powered sensors and devices that you put on bridges or on water systems or on street lights. You can monitor the status and the condition of those things.

So you can see here today it looks like an alphabet soup where in addition to Wi-Fi and LTE we've added millimeter wave and Z wave and Bluetooth. The wireless super cluster's going to write a blueprint on how these different wireless protocols compare to each other. What are the relevant use cases and make some recommendations for cities. So stay tuned and please consider joining in the activity of the super cluster. That's it. Thank you very much.

Jean Rice: Thanks Steve. That's great and I can't get by without a GT question. So this is for you Steve. When you look at the nexus of public Wi-Fi and IoT, what kind of wireless protocols do you see as the most relevant for the smart cities application?

Steve Wimsatt: That's a good question. You know, first of all there's not a right answer. The message going forward, they're not going to be one wireless protocol. You're going to have to manage multiple protocols. It's just going to be a little more complicated.

We think if you recognize that going in that shouldn't be an issue but for most smart city use cases we think you're going to be more interested in one of the long range wireless protocols like the narrow band LTE or LoRa or Zigfox. I think most of these are going to be looking at if you're going to outsource the network you're going to use a narrowband IoT from one of the mobile operators. But that's always going to require that you purchase that from a mobile operator because they own the LTE spectrum.

If you want to own and operate your own outdoor IoT network it's likely to be LoRa which is an unlicensed spectrum and is a very low cost network to deploy. We don't think those are – those aren't the final answers. There's going to be more. You just need to plan for a diverse set of protocol.

Jean Rice: I think that's right. I think it's also underlines the score that you know, once you build your system you're not done. You have to continually upgrade.

Steve Wimsatt: Correct.

Jean Rice: Okay. Thanks so much Steve. I've got questions from the audience. Let me give you the 1st one for Schenectady. Mayor McCarthy they're wondering if you're doing fiber optics to each street light and how are you handling the fiber? Is that fiber going to be available for commercial providers to provide small cells?

Mayor McCarthy: Jean, you broke up on the initial part of the question, if you could just repeat the beginning?

Jean Rice: Sure. They're basically asking are you going to put fiber between all of these new – between the street lights and is the fiber going to be available for commercial providers to do small cells?

Mayor McCarthy: Again we're looking at the final design of the deployment so that…we have a polite internal debate where we have Cisco as a partner. Of course they want everything to be Wi-Fi. AT&T wants everything to be cellular. It's how do you design the capacity in the system and we are looking to partner with people as we go forward where this is a demonstration project. So we're looking to try some components with different models but you have to have the capacity with the fiber.

The ones we're looking at today don't have fiber to every pole even though some people recommending that we look at putting fiber to every pole so that as you build it out over the next 10 years or 15 years that you have the capacity built in it.

Jean Rice: Okay that makes sense. We'll see how your demonstration goes. Maybe next year you can tell us what you found. Okay next question for Tony. Let me ask you this. What kind of tracking do you have for user access to determine how the access is being used and how to improve the service? An example that they gave for that was how do you track how many new visitors you have, that kind of thing?

Tony Batalla: Yes. We have a – our system is Cloud hosted. It's hosted by the partner who does…the service provider for us. They have built into that what's called an SCI platform and at the Ruckus products. So we have Ruckus equipment.

We deployed Ruckus before I met Steve but, you know, we did an evaluation early on and this was 2015 when we deployed and determined to go with that.

So they have a platform called SCI which does all the data collection and all of the dashboards. You can see all the analytics and I think it keeps 30 days worth of history. It's what we have it set right now but we could set it for whatever term, time period we wanted.

Jean Rice: Okay great. Thanks. I think that's a good answer and it shows that you've been thinking about it a while. Steve I have a question for you. What's your estimate of the average cost of the deployed access point, equipment installation, things like that?

Steve Wimsatt: That's a loaded question, smart question and I get it all the time. The issue is that it can vary by a factor of three and it depends on are we in a very dense location like Times Square, for instance, where you need a high end four stream access point? Are you in a more normal…90% of the locations we think you're more than fully served with a midrange two stream access point. The other big driver is to the earlier question, is there fiber in the ground or not?

A lot of cities have deployed a lot of fiber already. Most traffic control boxes are connected by fiber. If you're mounting an access point within 10 feet of the intersection where there's a traffic control box of fiber your cost to connect to that fiber is very, very low. If you need to trench 80 to 100 feet to run fiber through the base of a light to connect it then your cost is going to be high.

I'd say depending on the situation it could be $1000 and $3000. It can go higher than that. But it's – you really need to sit down and take an inventory

of your assets. Decide where you want to deploy and you have to ask some questions before you can really narrow it down.

Jean Rice: Yes good point. Now let me ask all three of you. I know these systems are in operating. They're working great but I know you had to hit a roadblock or two. Tell us, you know, what your roadblock was and how you got around it. Let me start with you Tony.

Tony Batalla: Sure. So early on the big roadblock, I slipped it into the presentation, one of the ones we found was our DACP server. So we had that configured. When we first bought it we had the controller so as Steve pointed out in his presentation the wireless system has a controller which really does all the management of the access points and how they all connect and what the policies are.

And we had configured it and had everything working and it seemed to be fine. But after we hit – it was like – I think it was 150 users, suddenly people couldn't connect anymore. It turned out to be that we had missed a line where we had to configure our DACP server to be excluded from some part of the configuration so that it would talk directly to it from the controller and we didn't do that. We spent the first few months banging our head on the wall. Why is this not…and we'd go out there and test it and everything was fine.

We're like everything looks fine. It was the middle of Tuesday in the morning, no one's out there but us so of course we can connect without a problem. We're like it looks fine to us. Come back and then on Saturday when they have a big event or something we'd inevitably get a call or an email from some business owner saying a lot of my patients are complaining.

That was another part. We ended up doing a lot of support with local businesses. We put the service out there and we released from the top of the, you know, rooftop we're screaming how great it is and then business owners are like okay, my clients can't connect. What's going on? You need to fix it. It took us a while so it's just technical challenges and that's where thinking about it, do you really want to support this in-house or do you want to work with a partner? What makes sense for you?

We're a small staff. We have ten people in IT and there's only – including myself and only a few of them are really network engineers. And so you've got your network engineers spending a lot of time working on this that's time they're not spending on something else. So those – that was probably the biggest one and looking back on it it's funny. It's like just a line in the code. Process of frustration early on.

Jean Rice: Really a couple minutes left, Gary or Steve you have a road block you want to mention quickly?

Mayor McCarthy: I think all the obstacles are always – first one is money. How do you pay for it? Some of these are clearly new technologies. They're new deployments to businesses, to the government entities and how do you work it in the budget? How do you cost – justify the cost and how do you ensure a positive experience or it's going to position it for long term adoption?

Jean Rice: Perfect. Okay well listen on that note I wanted to thank our speakers Mayor McCarthy, Tony and Steve for your great presentations. I think you did some very well grounded input on to what to think about as you deploy it, what the best practices are and then also kind of how you get around roadblocks and what are we thinking about in the future.

I think part of that is that as you keep participating I do recommend all of you try to look at that blueprint. They're going to try to input and deploy public Wi-Fi and it has a lot on the different choices you can make and…as well as you go through it technical ownership and others. I do think that the key for this is to look I think what Steve said about what are your use cases and what Tony and the mayor talked about too. What are the cases that you're trying to say? What are the problems you need to solve and how can your deployment of Wi-Fi fit into your smart city infrastructure plan?

I want to thank all the participants of the webinar who joined us and our speakers. Thank you very much. Have a good day.

Mayor McCarthy: Thank you Jean.

END