

NWX-DOC-NTIA-OTIA (US)

**Moderator: Scott Woods
September 19, 2018
1:00 pm CT**

Coordinator: Welcome and thank you for standing by. At this time all participant lines are in a listen-only mode and will be for the duration of today's conference call. Today's conference call is being recorded. If you have any objections to this, you may disconnect at this time.

And now I would like to turn the call over to your host for today, Mr. Scott Woods. Sir you may begin.

Scott Woods: Thank you very much (Brad). Good afternoon everyone. Thank you for joining us today for BroadbandUSA's Monthly Webinar on broadband topics and issues of interest to the public.

I am Scott Woods and I manage BroadbandUSA's Technical Assistance Program and will be moderating today's Webinar.

Today our topic is Innovative and Emerging Technologies Providing Economical Alternatives for Rural Broadband Access. As we all know, broadband is critical to the economic development and vitality of communities across the United States. Given its importance, state, local, and community

leaders are constantly exploring how to expand the availability, utilization, and adoption of robust, high quality, and affordable broadband services in their communities.

Today or featured speakers will discuss their next generation projects and the innovative wireless technologies that are currently being tested and deployed to address rural broadband connectivity.

Our presenters today are, collectively from OptiPulse, Mr. John Joseph, the Founder, Inventor, and President. And Mathis Shinnick the Chief Executive Office.

We also have Therese Jones the Senior Director of Policy from the Satellite Industry Association. And in partnership, Mr. Keith Walker, the Chief Executive Officer of Aer Wireless, and Dr. Sisso El-Hamamsy, the Chief Executive Officer from Mage Networks.

But before we begin I would like to review the protocols for today's Webinar. First we will open up the Webinar for questions after the completion of all the presentations. Please use the question box on the right-hand side of the screen to submit your questions or comments.

Second, the presentations along with a transcript and recording of today's session will be available on the BroadbandUSA Web site within seven days of this Webinar under the Events/BroadbandUSA Webinar Archives tab.

Finally, please visit our BroadbandUSA Web site for information about our Technical Assistance Program including access to useful guides, products, publications, and other tools that can assist you with the planning, funding, and implementation of your broadband projects.

As we begin our first speakers are John Joseph and Mathis Shinnick of OptiPulse, Incorporated.

Mr. John Joseph has over 35 years of compound semiconductor processing and laser design experience including stints at Sandia National Labs, Los Alamos National Labs, Motorola, MicroOptical Devices, Novalux, and more.

In addition he has seven years of C-level executive experience with startup enterprise companies. He holds 12 patents in laser electrical optics including OptiPulse's Light Grid technology.

Prior to founding OptiPulse he founded and launched three successful startups including TriLumina Corporation which has commercialized one of his earlier laser electro optic patents.

As the Founder, President, and Chief Operating Officer of OptiPulse, John is leading the development of Light Grid technology and building a top-tier technical and management team at OptiPulse.

Mathis Shinnick is a globally experienced Senior Executive with over 35 years of experience in startup entrepreneurship, finance, organizational design, and business management.

As a C-level executive across multiple sectors, he has built technology, asset management, and financial services companies in the U.S., Asia, and Europe.

As CEO of OptiPulse, Mathis is leveraging his management, finance, and interpersonal expertise to build a world class organization leading OptiPulse's

business development in multiple markets including the cultivation of major strategic players and driving the company's capital investment efforts.

Please welcome at this time John and Mathis.

John Joseph: Hi, this is John Joseph. I'd like to talk to you a little bit about a new technology that we have developed and have demonstrated. The technology is based on light. It's transmitting light as ones and zeros over distances.

And we have demonstrated that we can make a small semiconductor chip that's very effective cost wise to produce these on a large scale and put them in a system with a few lenses and the high speed electronics necessary to send broadband links wirelessly across the distances.

We believe that this technology will be critical in hooking up very high speed ten gigabit plus lines. We believe we can multiplex this up to super highway type speeds. And I'd like to discuss that a little bit with you today. Let's go to the next slide.

So this unique photonic source is an array of semiconductor lasers that you can't even see they're so small, by the human eye. On a small chip we can put these lasers. And we also can put lenses on the same chip and that creates a light source that comes together at a specific convergence point allowing our optics to take advantage of this by collimating it in a beam.

This beam is basically has the same wavelength as your remote control at home virtually. And is also eye safe after it comes out of the lens.

So we can fabricate these chips in very high scale operations where a one four inch wafer can have 20,000 chips on it. and each one of the chips, after its diced up, can virtually be less than a dollar.

So it's very cost effective to build these systems. And we are putting again, with a lens in an optical system and high speed electronic in order to bring the system into a type of technology that we can put on a small tower or wherever nodes are that need to be hooked up. Whether it's in the metro areas, urban, or rural.

So we believe that these systems we're demonstrating now can be placed and create a mesh network with this. So let's go to the next slide please.

So our mission at OptiPulse here is to really build out a higher speed infrastructure. And this infrastructure will be based on a mesh network. The mesh network basically means that on these point-to-point connections, if you have multiple point-to-point connection at every node then if anything gets in the way of one of them you'll have the ability to continue the network through the other or multiple connections.

So with our disruptive capabilities we believe that we can deliver a very affordable access to as many underserved people as possible. And that's our mission is to make - connect as many people as we can with this technology and bring them very high speed broadband at a utility type price.

So we're trying to drive the price down, increase the speed, and we believe that we can make the common network stronger and faster.

The situation that we're in now is we are building early prototypes. And these prototypes are about to be deployed at an educational facility. And using - in

order to wirelessly hook up the students in certain areas with extremely high speed wireless for their laptops and phones.

The next generation prototype -- we'll show you these here in a second -- we are on Prototype 3 and they're testing it right now.

The global benefit of this technology is really, we want to be able to decentralize and distribute the commercial potential to the public itself. So we're going to offer in a number of ways, the actual consumer can take advantage of these systems while hooking up their neighbors.

And so we will go into this at some point in the future, but that's our benefit we see is that we'll be able to put these networks in rural areas for cheaper than it costs to get fiber down there at the present time. And we'll be able to enhance telemedicine, tele education, job training, IoT application, basically create an information base for rural communities that don't have it right now.

Current investors are Plateau Telecommunications which is very mature telecommunications company in southern that operates across most of New Mexico but, based out of the southeast portion of New Mexico. And they are working with us very closely to be able to tell us what their needs are for wireless communications. And we're very excited to be partners with them.

Also, Sacred Wind. Sacred Wind is also a telecom company here in New Mexico. And they are specifically helping hook up the tribes in the northern part of - northwestern part of New Mexico to people that do not have current access. And we want to work with them very closely to be able to provide our equipment and help these underdeveloped regions locally and across the globe. Next slide please.

You can see here that we've had a few prototypes. We've sold and delivered Prototype 1 successfully with a Simplex ten gigabit per seconds Simplex unit.

Prototype 2 was completed and it is a duplex ten gigabit per second duplex where we demonstrated virtually no errors with a ten gigabit per second duplex link that has SFP Plus plug and play fiber in and out of it.

And we're currently building an assembly Prototype 3. You can see it here on the right photograph. And that is going to be deployed at a college here, local New Mexico college, College of New Mexico, here in a few weeks. Just in the final stages of putting this up and deploying it. Let's go to the next slide.

So our job here in New Mexico, we're starting in Albuquerque and the rural communities. But within Albuquerque we believe we can bring more of a smart city broadband in this urban environment. So there are many areas where buildings need to be connected.

And also actually downtown some of the fiber connections that were put in, in a recent construction phase of improving Albuquerque has given us the opportunity to take those fiber connections and then distribute the wireless information to neighborhoods north and south of the street.

And so we're in the planning stage of that and we are working with contractors and equipment manufacturers in order to distribute the last mile and curb the home in those areas.

And so we're in an early stage development of planning and deploying these networks.

Prototype 4 will be our actual product where we will see these - all of the nodes and the mesh network dynamics. We can go to the next slide.

So our solution for the next generation, the 5G is coming. And we all know what 5G is. It has to be here. We believe that we are the best alternative to be - to bring 5G wireless because bandwidth of at least ten gigabit per second is necessary for backhaul in order to make 5G wireless effective. And we are working very quickly to be able to provide that backhaul service.

So the opportunity here is basically to be able to provide not only 5G infrastructure for cellphone service, but also for wireless connection to the networks. And we can go to the next slide.

So it's critical for us to develop the public access mesh networks with - here you can see this is a concept that we are working on. But it's basically being able to hook up multiple wireless nodes to businesses and even homes. And we are now working a point-to-multipoint of our technology to be able to hook up homes even to one gigabit per second with a very cost effective price point for that. So let's go to the next slide please.

This will also allow us to develop the kinds of smart poles to provide a high bandwidth network to provide services within the city. But basically be the high speed backbone for the city and rural communities. Thank you very much.

Oh, and here is our contact information on the last slide. Please give us a call or email us if you have any questions. Thank you.

Scott Woods: Thank you John. As a reminder we will have time for questions at the end of today's session. Please use the question box on the right-hand side of your screen to submit questions and/or comments at any time.

Our next speaker is Therese Jones from the Satellite Industry Association. Therese joined the Satellite Industry Association as its Senior Director of Policy in January of this year.

In this role Ms. Jones support SIA's work on government services. Legislative affairs, defense, export control, and trade issues of critical importance to the association's members.

Prior to joining SIA Ms. Jones was an Assistant Policy Researcher at the Rand Corporation where she focused on space policy. In this role she supported the Department of Defense, Department of Homeland Security, the National Geospatial Intelligence Agency, the U.S. Air Force, and the United States Army in assessing new space technologies, increasing the resilience of the national space architecture and determining commercial acquisition strategies for communications and remote sensing services.

Please welcome Therese Jones with the Satellite Industry Association.

Therese Jones: Thank you. So I'm Therese Jones representing the Satellite Industry Association. We're a collection of around 47 satellite related companies that are owners, operators, manufacturers of satellites and manufacturers of ground equipment.

And if we go on to the next slide this is just an overview of the satellite broadband infrastructure today. So satellites provide SEC defined broadband

coverage of 25 megabits per second down and three up across the world - most of the world today.

And they're used in the maritime industry, in aviation, I'm sure a lot of you have used inflight Wi-Fi, although some of that is still provided from terrestrial companies.

In agriculture for things like livestock sensors, soil monitors, autonomous farming, used for remote oilrigs, and used in Telehealth.

Just to give you some idea of the scale of what the satellite Internet provides to the economy, according to Northern Sky Research, satellite Internet was responsible for about \$600 million in oil and gas revenue in 2010. And it's projected that it will be responsible for \$975 million of revenue in 2020.

So providing this Internet access to remote locations is very economically beneficial. And satellite Internet is even so good that it's currently used by Airforce 1. So it's good enough for the President of the U.S. Hopefully it's doing a pretty good job for your average consumer as well.

If you move on to the next slide this is just a quick overview the number of satellites in orbit right now that are communications satellites in geostationary orbit. This is a special orbit above earth where satellites revolve around earth at the same speed the earth is rotating. So they stay overhead in one spot all the time.

So you launch a satellite above whatever area it is you want to cover. And the industry is constantly launching more and more satellites.

Going on to the next slide, so these geostationary satellites currently provide broadband service across the entire continental U.S. And they provide service in all 50 states; Puerto Rico, the Virgin Islands. The only place that they have a hard time covering is northern parts of Alaska. They provide coverage over the most populated parts of Alaska in the south. But just because of the geometry, have a hard time reaching the north.

And there are two main providers in the U.S. right now. EchoStar Hughes and BioSet. You can directly buy service from EchoStar Hughes. BioSet distributes its services through third parties.

And satellite Internet speeds have gotten quite a bit faster over the last few years. We run into a problem in the industry where everyone has this picture of satellite Internet decades ago that's very sluggish and much like dialup was back in the day. But now these companies are offering service of 100 megabits per second across the U.S.

And it's also pretty comparable in price to terrestrial offerings though the prices depend on your location. And unlike previously, there are no hard data caps at all on any of the consumers.

These companies may end up throttling service if their networks get too congested, a lot like wireless providers do today. So, there are no hard data caps.

Another problem that we've run into with satellite Internet service is that the FCC doesn't include satellite broadband access when it's talking about who is underserved by broadband.

So as I mentioned before, satellite broadband service is available across the entire continental U.S. that's not in the FCC's count. And the industry is not capacity constrained now. So wherever you are in the U.S. you should be able to get satellite service relatively quickly. We have installers in every state who can just come set up satellite Internet regardless of where you are.

And unlike terrestrial services, satellite companies don't use subsidies to come to you. They don't have to install many miles of wires to get to wherever you are. You just have to call them up and they'll install the service for you.

They're around two million customers subscribed to satellite broadband service in the U.S. today which is a growth of about 5% since 2016. And the service is incredibly reliable. I'm sure many of you have had Internet outages from terrestrial providers.

Satellite services are more or less always there. And they've been really critical in things like disaster relief efforts. For instance, last year in Puerto Rico and the Virgin Islands, they were the only cell service across most of the island.

And we've actually heard from NGOs in Puerto Rico and the Virgin Islands that they really think satellites need to be part of their critical infrastructure because they're always there.

Moving on to the next slide, this is just some of the satellite - the innovation that's going on in the satellite industry. We created these high frequency satellites that allow for reuse of frequencies and bandwidth. And it creates these small spot beams that can provide higher towers to locations. And you can actually direct these spot beams to areas of higher demand. And it's increasing satellite capacity by even 18 fold for some satellites.

It also reduces the cost per bit delivered to the consumer by you know, around 100 fold for satellites with this technology versus traditional technology that just has broad beams. And the satellite industry is continuing to innovate in each satellite that it - for each new satellite it launches.

Moving on to the next slide, this is just to give you a quick overview of, there are a number of non-geostationary satellites that have been launched and are about to be launched that also do communications.

So the geostationary satellites run into a bit of a problem in that they have some latency. Just due to the speed of light it takes about half a second to go up and back down with geostationary satellites. So you don't notice this in streaming your favorite TV shows via Netflix or anything. The satellite companies have managed to make sure that that's smooth.

But if you're doing something live action gaming you might notice a lag. And a lot of that lag will decrease once we have these satellites that are in much lower orbit blanketing the earth. The issue is having the satellites in lower orbit is that you need a lot more of them.

So if you go to the next slide you will just see that these are all the planned satellites that have been filed with the FCC. They are around 21,000 of them proposed by 13 different companies that are intended to blanket the earth. So there should be a lot more and, they're going to be launched from you know, from around 2020 to 2025. That's the proposal. And there should be a lot more satellite Internet options once they've been launched.

Moving on to the next slide, satellites are going to continue to play a big role in the future of Internet coverage in the U.S. and even in 5G. They'll play a huge role in mobility operations.

The school of economics estimates that satellites provide a \$1 billion Internet market for planes right now. And that's likely to be \$30 billion by 2025. It could save airlines around \$15 billion a year in operating costs just because they'll provide Internet connectivity to planes. Not just connectivity for the passengers themselves, but allow the planes to connect to the ground, do updates, and just be broadly connected to the Internet of today.

Satellites will be able to provide things like, for backhaul capacity in cases of congestion on terrestrial networks, they can provide direct to beams that can do temporary networks for things like concerts and sporting events. So I don't know about you, but I've lost friends at crowded sporting events before where we can't get Internet coverage because too many people are trying to be on the - trying to join the network. Satellites can fix that.

So the idea is that they'll complement the terrestrial networks, be able to provide things like updates to autonomous vehicles. Yes, just help all mobility devices stay connected and continue to reach underserved areas.

If you go on to the next slide that's just our contact information. Feel free to contact us at info@sia.org if you have any questions about satellite broadband capabilities. And I'd be happy to answer them or get you in touch with some of our providers. Thanks.

Scott Woods: Thank you Therese. As a reminder we'll have time for questions at the end of the session. And a full recording and transcript of today's Webinar sessions will be available within seven days on our Web site.

Our final speakers today in partnership are Keith Walker and Dr. Sisso El-Hamamsy.

In his third decade in the telecom, technology, and wireless industry Mr. Keith Walker focuses on the planning, design, and deployment of telecom, data, and wireless networks and call centers.

Mr. Walker is a veteran of the United States Army 82nd Airborne Division and is the recipient of numerous military awards. He has also received two Congressional nominations to the U.S. Military Academy at West Point, New York.

Mr. Walker is a graduate of Occidental College in California where he earned a BA degree in Diplomacy and World Affairs with an emphasis on East Asia. He also attended Claremont Graduate School at the Peter F. Drucker Center for Management.

Mr. Walker honed his technical skills at GTE, GTEL, now Verizon, AT&T, SBC, Sprint, MCI, and Lucent Technologies, and played a significant role at Grit Communications prior to and after the company's initial public offering.

Dr. Sayed-Amr, we call him Sisso, El-Hamamsy is the Co-Founder, President, and CEO of Mage Networks. He received his Ph.D. from the California Institute of Technology in 1986. And from 2001 to 2005 he worked at Wi-LAN, now known as Quarterhill, as the Chief Operating Officer, then President and Chief Executive Officer.

Under his guidance and leadership Wi-LAN became a founding member of the WiMAX Forum, changed FCC regulations in the 2.4 gigahertz band which

enabled the introduction of Wi-Fi's 802.11G standard and the derivative consumer products, and was the leader in developing the standard for future broadband wireless access.

After Wi-LAN he co-founded several companies that developed wireless solutions for the oil and gas industry. Dr. El-Hamamsy has numerous publications and has received 46 U.S. patents. Please welcome Keith Walker and Dr. Sisso El-Hamamsy.

Keith Walker: Good afternoon everyone and thank you for having us. First let me start here by pointing out that Aer Wireless is a next generation broadband services provided with a focus on delivering high capacity, affordable, reliable broadband services to rural America. Affording governments at the state, county and city levels to provide the engine for economic development, helping businesses thrive, helping farmers use our network as a tool on their farms. And most important of all, providing a great quality of life for the residents.

The mission of Aer Wireless, working with its partners, the primary one being Mage networks, is to be able to deliver Wi-Fi or broadband services everywhere, leaving no area untouched or underserved. Next slide please.

The current environment has about - here in the U.S. about 55 million persons, households with a lack of access to broadband. Some of the other issues are slow speed. And that its current infrastructure is prone to signal degradation which affects the upload and download speeds as we all sometimes experience, depending on which network we're using.

And the other primary issue that is faced by many of the communities and listeners on this call is the high cost of infrastructure, primarily fiber. And the reliability of these networks.

What Aer Wireless is able to do and the advantage that we have is a quad play where we are able to deliver faster speeds using the 802 - currently the 802.11n which can deliver up to 400 megabits per second, the 802.11ac, and ax respectively delivering 1.5 gigabits to 2 gigabits per second.

Our networks are faster and more reliable and has the ability to provide for law enforcements and first responders, to access multimedia communications, not just to voice.

And also as I will touch on if I'm able to throughout this sessions - quick session here, what we're able to do with 9-1-1. Most importantly our deployments are low cost and can be provided rapidly. Next slide please.

What you are seeing here is just a depiction of the city, the farm, and a rural area and the fiber optics. What we are able to do in these areas is rapidly deploy our networks. And deploying those networks so that the consumer, which we have determined quite some time, as far back as 2010, wanted the bandwidth for their devices.

When we think about how often or how many hours a day we spend at home, in some instances we don't spend that much at home. However, while at home we still want that connectivity. And Aer Wireless in its deployment practices are able to deliver the broadband to the homes and also deliver broadband or the fast speeds that you require, directly to your devices. Next slide please.

What we're able to do when we deploy these networks in the cities, the counties, or the communities is that businesses are now being given tools to foster and increase productivity while attracting - while the cities are able to use these networks to attract companies to come to their cities.

On the residential side the residents now have a full plethora of services to choose from, and having good, reliable, fast services that are not throttled.

In the municipality and the public entity end, these services are now available to help with solutions such as providing law enforcement with good communications in those areas of the county or the cities where they do not have any communications. And with the situation with first responders, that as well.

In most of the communities when we think about rural America, any communities where there are outdoor trails, parks, and hiking areas oftentimes the users of these locations have problems receiving the signals. And so with our network they are able to do that.

With the public access, when we deploy a network in a city or a county we blanket the entire area. No longer are you restricted to when you leave your home or Starbucks you lose your connection. With these networks you can walk, run, ride, drive and stay connected to the wireless network.

On the right side of the screen is an example of some of the equipment that is used to deliver the services that we offer to our customers. Next slide please.

In the summary of the technologies, we are only limited by the number of data pipelines that we deploy from any single point for the coverage area. Again, we do not need towers. And the ability to access and get around obstacles,

bypasses, and dense foliage to reach 100% of the customers that we're seeking to reach.

The range - typically with the degradation of signals from towers if you're using towers, we do not have that problem. We with Mage, have been able to test the data pipeline as far as 20 kilometers without any degradation.

Deployability - we do not need rand engineers or high skilled persons to deploy our networks as we have shown in one of our demonstrations, how rapidly these networks can be deployed.

And the usability is that with the speeds and the usage, just about every device that is there that comes out today has a Wi-Fi chip set in it. Next slide please.

One of our partners - one of our main partners to deliver this solution is OVH where they can turn up a Cloud or a core network in virtualized form in about 48 hours. And that's very important because on the one hand you have the wireless network. But key to this is the core of the network.

And some of our other partners also include Cogent, providing the IP bandwidth; and other partners to help deliver fiber if the customer so decides. Next slide please. Hello? Okay.

One of the things that I mentioned in terms of some of the challenges that some of the cities have with regard to getting signals in trails and stuff is also getting emergency signals out as identified by the FCC when they took a look at the emergency alerting systems.

UgoRound is one of the partners that we work with to help cities get emergency notices out and also other immediate notices that they would want to get out. Next slide please.

While we're waiting for the next slide to turn, one of the challenges that most of the cities in our country has is the FCC has asked for an improvement of 9-1-1 availability to mobile devices. Traditionally 9-1-1 was built on fixed locations, buildings and the like.

However, due to the proliferation of digital devices, the FCC has asked for this to change. With our network deployed and working with Aradial, we're able to deliver the - we are able to help the first responders get within 200 meters of the person that called for assistance.

And I believe while you may not see it, the last slide will be our contact information should anyone need to have any follow-up questions or seek any information on us. Thanks very much.

Scott Woods: Thank you Keith. Sorry for the technical issue that we had. We'll put that slide back up. Dr. Sisso, we'll queue your slides right now. So we apologize for the technical glitch but, we are working on that and we'll put that up shortly.

There we go. Okay. Please welcome Dr. Sisso El Hamamsy.

Dr. Sisso El-Hamamsy: Okay, thank you all for being here. I want to introduce you to the concept of MagiNet which is a concept that we've developed and which enables a lot of the things that Keith has mentioned prior in his previous comments. And we're titling it, How to Reach the Three Billion Unserved. So we're viewing this as something that help in the worldwide solution.

MagiNet is the network solution for wireless which utilizes proprietary technology and it promises to solve the connectivity problem for the three billion.

In addition we believe this will be an enabling technology for the Internet of Things, 5G, and autonomous vehicles and other applications in the future. Next slide please.

So what is MagiNet? It's a very high capacity, multi-hub network. And it's built on two fundamental pieces of technology which is a wireless mesh technology which is truly robust. You will hear a lot of talk about mesh technologies in wireless, in radio frequency wireless to clarify, where they will talk about an extender - range extender or something like that. These are one hop, two hops, maybe three hops maximum.

We talk about robustness that can then be deployed countywide, statewide, and so on because it can be used with up to 100 units. And we've tested it with 25 hops. No one can truly do that right now.

And the other part of it is this data pipeline concept which allows us to go many, many kilometers or miles. And the current capability of it is 50 megabits per second. But as Keith mentioned, with the advance AC data pipeline. And with the AX, we will be able to move up to one gigabit per second and so on.

The cost of it is a fraction of other systems. And it works in the line of site environment because of the nature of the network as I will explain in the next slide please.

So where does MagiNet fit? It does not replace all the things that you may have already. It starts where fiber stops. It starts where towers are not cost effective. It goes where terrain, hills, and mountains and woods prevent connection. It goes where obstacles prevent connection. And it also is very cost effective where the population density is low.

And if you recognize this area, these are exactly where the three billion unserved live. And probably where you yourselves are located. Next slide please.

So this slide compares side-by-side. On the right side a standard tower configuration, point to multipoint with three frequencies, the yellow, the green, and the red. And so you rely on line of site from any point on that circle to reach the tower.

And several things happen there. If there are obstacles then you may not see the tower at all. The energy from the towers going to areas with no customers, as well as the data rate declines as you move away from the tower.

On the left side you see this kind of spider web, weird tangle of lines. These are the data pipelines. The lines in black are the data pipelines. The red line that you see in the center is a point-to-point link, so showing how we can use standard wireless technology go point-to-point and start another bunch of data pipelines from the same spot - from a new spot I mean; sorry.

And as you can see, the little green, yellow, and red circles would represent for instance, in this particular example, an LTE access point which would be very small picocells. And they would be able to access and give you very high data rates wherever you are in this whole area.

A few things that you can notice that the extent of the range coverage goes beyond where the circle on the right goes because the data pipeline does not suffer a decline in data rates through the multiple hubs.

And it also does not go and waste energy in areas where there are no populations. So it's very targeted. One way to think about it is, if you're doing - irrigating a field by flooding it, which we do in my native Egypt, or if you're doing drip irrigation where you're putting the water exactly where you need it, the data pipeline is equivalent of drip irrigation. The traditional point to multi-point is the equivalent of flooding kind of irrigation. Next slide please.

Okay, so the paradigm shift here is that with MagiNet, as they go high and build high towers, we go low. We keep our units to 10 to 20 feet height.

Can we go back another slide please? I don't know why it keeps jumping.
Can we go back a slide?

Anyway, the bottom line is that MagiNet -- okay, thank you. And they have to go with high power. We actually reduced the power so that the relays that we use are very inexpensive, cheap, can be run on solar panels with batteries so they can go in very difficult terrain.

So they go long distances. We actually go short distances. And they go with wide beam antennas. We go with narrow beam antennas. And next slide please.

So what does that mean? It means that because we're going short hops we can go from hilltop to hilltop for instance, in very rugged terrain and get 100% coverage. Or we can go around forests instead of going through forests. Or

we could go and the MagiNodes are also very quick and easy to deploy. Because as I said, low power, low power consumption, they are very small units.

It maximizes spectral reuse. This is very technical. Because we're not going high and we're not broadcasting all over the place, we can keep reusing the frequencies. And then that allows us to provide very high capacity in the area of interest.

And it also minimizes interference because if my antennae is a narrow beam antennae, then the interference will only happen when someone is in my beam, and not something that's outside the beam.

All of that combined helps increase the data rate and helps also reduce the weather effects. Because the amount of distance that the RF signal is traveling through rain for instance, is a lot lower which means that the amount of fade would be smaller. Next slide.

We have been - we are commercial and we have been doing a lot of testing, as well as have a few commercial deployments. We have done continuous Wi-Fi in the City of Taber - in Alberta, sorry, the Town of Taber in Alberta. It's a rural community. And they've expanded their network to cover the continuation park, as well as the whole long area in the downtown core. They're very happy with the network and they plan to expand it ever more.

We've done a municipal building and sports complex Wi-Fi in Brazeau County, also rural community in Alberta. And we've done the home Internet Network in Waiparous Alberta. I'm going to talk about that a little bit more.

And the other three are tests. And I'd like to point to the last line there where we have a YouTube showing a demo of a data pipeline being installed in a prairie kind of area where we could go about six miles outside of the town.

And in that six miles -- and this is the key -- we pass by six or seven ranges and farms. And that data pipeline could connect all these ranges and farms very cost effectively. For maybe \$10,000 or \$20,000 you can reach those farms. I do not believe that there's a way of doing that inexpensively with any other wireless technology. Next slide please.

So the next slide show the Village of Waiparous. We picked that village because it is what we've nicknamed it, Wireless Town. It is full of trees - Pine trees, so they're there all year round.

The terrain is extremely rugged. It's got two mountain ranges almost meeting. It's got a very deep ravine with a river, the Ghost River flowing through it. And very few people there have any kind of Internet connectivity.

So we were able to use this - if you look at the blue line there, this one house has actual line of site to a tower. And we start from that house and developed the data pipeline currently connecting five or six homes. And we are in the early stages of you know, this pilot. But that terrain is particularly difficult. And we have shown how we can overcome it.

So between this one and the demo that we've done in more prairie, more open terrain, we believe that we can cover almost any ground that we may be facing at home. Next slide please.

So MagiNet can reach the three billion unserved. The rural communities don't have to compromise between the rural lifestyle and being able to do the business or have the kids go to school.

The cost of our network, depending on the situation, is between a third to one-twentieth of other technologies. But it works best as part of a full network, the way Keith described it, where he is using fiber, fixed wireless access, and MagiNet together to provide a comprehensive solution. It works. Next slide.

Just try it. Thank you.

Scott Woods: And thank you Keith and Dr. Sisso. And thank you to all of our speakers for sharing your expertise and overview of your projects and the underlying new technologies.

Now we will open the webinar for questions from our attendees. Aimee Meacham, my BroadbandUSA colleague will facilitate the question and answer session. Thank you Aimee.

Aimee Meacham: Thank you Scott. So I have a few questions that are really common to each of the speakers today. And I wanted to start with sort of the first and easiest group of questions which is one, if you could each address how your technologies are affected by weather. And how they would be affected by like large foliage or heavy trees in say like a mountainous terrain or in a densely forested area.

And if we could start with you know, with John and then Therese, I would appreciate it.

John Joseph: Hi, this is John with OptiPulse. So our technology, the laser is spread out of the chip. But when they go into the lens we have a four to six to eight inch beam, depending on the distances that we are covering.

So when the beam comes out of that lens it - weather, snow and rain can definitely be in the beam line without an effect on the ten gigabit per second or performance of the device. We only need about 10% of beam to actually get through.

And at any one point in time the data is traveling so fast there will be some portion of the beam that is getting through. So the answer is, it doesn't - the rain and snow and sand and stuff doesn't really affect the beam. However, fog does. And we need to, in the instance of fog we need to bring our links closer. And we also need to overcome it with higher power which we're able to do with just a few more lasers on the chip.

Aimee Meacham: Thank you John. There's?

Therese Jones: Hi. So satellite internet isn't normally affected by normal rainstorms or light snow, but in the case of very severe weather it may go out for a few minutes, up to around 20 max. Even if it continues to rain or snow longer than that you can normally acquire other satellite service.

An advantage of - well in terms of foliage, because these satellites are in a fixed spot in the sky, you should be able to point them in the correct direction and know if you have coverage or not (unintelligible) the foliage. And point them in the correct direction and know whether or not you'll have service consistently.

But with these new non-geostationary satellites that are coming on line, there are going to be multiple satellites overhead at once. So that will really help alleviate this problem of any outages or any sort of foliage decreasing power to your satellite.

So you'll have multiple options and be able to switch off between satellites to get coverage. And you should have continuous coverage then.

Aimee Meacham: Thank you. Keith or Sisso do you want to take that?

Keith Walker: I'll let Sisso get that.

Dr. Sisso El-Hamamsy: Yes, I'll take that. So as I actually mentioned in my presentation, our system is designed to minimize the effect of frequency -- I'm sorry -- of weather and rain and so on.

We recognized from the very beginning that this was a major issue in rural broadband. And we've designed the system such that it will reduce the impact dramatically.

And as you can see from my presentation that we have deployed the first - one of our first deployments in heavily wooded, very densely treed, and very rugged terrain. This area in Waiparous was picked particularly for that reason.

So we're very confident. And again as our tests have demonstrated, we are able to overcome these problems consistently and with a very clear methodology to do so. So that you know, installers can be trained very easily to complete the deployment with very minor directions from us.

Aimee Meacham: Great. Now I think you - back to Sisso, you talked a little bit about how the Mesh network worked and how many connections you need to get back to the backhaul and how long your connections could be.

Well one of the questions that came in was like, how many - you know, how many like actual towers would you need? Can you address that quickly?

Sisso El-Hamamsy: Yes. For MagiNet specifically, there are no towers needed. They can be mounted on lamp posts, on fence posts, on anywhere, on homes themselves. Anywhere where there is power. If there is no power available as I mentioned earlier, you're able to use solar panels and so on to operate them very effectively. Because the power requirement is very low. They consume approximately five watts. And that means that a solar panel size for that is not too large.

And so we don't need towers however, we would incorporate towers. In situations where there is a tower with fiber access, we would start the data pipeline from there. But other than that we actually do not need towers.

Aimee Meacham: Okay great. Thank you. And I'm just going to ask a couple of more questions because I know we're running short on time. And thank you to everyone that submitted questions. You submitted excellent questions and we'll encourage you to ask those directly of the speakers off line.

But back to John, one of - in OptiPulse's decentralized models, can you talk about how the nodes distribute coverage to the last mile?

John Joseph: Yes. So the nodes would be for the high speed backhaul. And that's what's important in the distribution of a network. However, we would use off the shelf parts in many cases, just like Dr. El-Hamamsy's devices.

So we can use multiple types of off the shelf radio units. And we are now developing a point-to-multipoint emitter that allows us a wide, broad area that many connections are connected virtual to from a line of site of the central node across multiple houses and/or regions that can hook up the same exact device. Much like a network that's in your house right now where you have multiple users on it.

But again, we are deploying with the last mile with off the shelf devices, radios, and even the new equipment that we're seeing on line now. And in the near future the line of site, point to multipoint could be able to bring up to five gigabits a second to your home. Thanks.

Aimee Meacham: Okay, thanks. And the other big question for you is, is OptiPulse ready to deploy yet?

John Joseph: We are deploying our first unit at the College of New Mexico here in three weeks. And we're testing it here next week in our lab. But it's already got much, much higher capability than what we believe it had.

So we're very close to deploying the first unit. And on speaking on that, we are asking the public to help. We have just filed our fiber 6E which allows us to get accredited investors. The more resources we have the faster we can get this technology to the public and to make these Mesh networks mini connections.

Aimee Meacham: Right. Okay, thanks. And one last quick question for Therese which is, can you tell us what a spot beam is? I think that was flagged.

Therese Jones: Yes, so it's a small beam of 100 kilometers in width.

((Crosstalk))

Aimee Meacham: Make sure to mark down your comments.

Therese Jones: Hello? So it's a small beam that's around 100 kilometers in width which has much higher power than your normal broad beam. And you can point it directly at locations with high demand.

((Crosstalk))

Aimee Meacham: I'm sorry. I think someone is not on mute, so sorry about that. But thank you Therese. And it looks like we are all out of time so Scott, do you want to wrap us up?

Scott Woods: I do. Thank you Aimee, very much. Thank you everyone for your questions. As we conclude today please note that BroadbandUSA's Practical Conversations Webinars are scheduled for the third Wednesday of each month at 2:00 pm Eastern Time.

Please join us again on Wednesday October 17, for the next webinar entitled, Federal Broadband Funding, Policies and Programs to Connect America.

And as a final reminder BroadbandUSA is available to provide technical assistance to help expand broadband connectivity, promote digital inclusion, and broadband adoption. For more information please visit our web site and access our toolkits, our guides, and publications.

Thank you all for joining us and have a great afternoon.

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