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LEADING THE WIRELESS FUTURE: SECURING AMERICAN NETWORK TECHNOLOGY

WEDNESDAY, APRIL 22, 2021

House of Representatives,

Subcommittee on Communications

and Technology,

Committee on Energy and Commerce,

Washington, D.C.

The subcommittee met, pursuant to notice, at 11:30 a.m., via Webex, Hon. Mike Doyle [chairman of the subcommittee] presiding.

Present: Representatives Doyle, McNerney, Clarke, Veasey, Soto, O'Halleran, Rice, Eshoo, Matsui, Welch, Shrader, Cardenas, Kelly, Craig, Fletcher, Pallone (ex officio), Latta, Guthrie, Kinzinger, Bilirakis, Johnson, Long, Hudson, Mullin, Walberg, Carter, Duncan, Curtis, and Rodgers (ex officio).

Staff Present: A.J. Brown, Counsel; Jeff Carroll, Staff Director; Parul Desai, FCC Detailee; Jennifer Epperson, Counsel; Waverly Gordon, General Counsel; Tiffany

Guarascio, Deputy Staff Director; Perry Hamilton, Deputy Chief Clerk; Alex Hoehn-Saric, Chief Counsel, Communications and Consumer Protection; Kate Arey, Minority Content Manager and Digital Assistant; David Brodian, Minority Detailee, C&T; Sarah Burke, Minority Deputy Staff Director; Michael Cameron, Minority Policy Analyst, CPC, Energy, Environment; William Clutterbuck, Minority Staff Assistant/Policy Analyst; Theresa Gambo, Minority Financial and Office Administrator; Jack Heretik, Minority Press Secretary; Nate Hodson, Minority Staff Director; Sean Kelly, Minority Press Secretary; Peter Kielty, Minority General Counsel; Emily King, Minority Member Services Director; Bijan Koohmaraie, Minority Chief Counsel, O&I Chief Counsel; Tim Kurth, Minority Chief Counsel, CPC; Kate O'Connor, Minority Chief Counsel, C&T; Clare Paoletta, Minority Policy Analyst, Health; Arielle Roth, Minority Detailee, C&T; Olivia Shields, Minority Communications Director; Peter Spencer, Minority Senior Professional Staff Member, Energy; Michael Taggert, Minority Policy Director; Evan Viau, Minority Professional Staff Member, C&T; and Everett Winnick, Minority Director of Information Technology.

Mr. Doyle. The committee will now come to order. Today the Subcommittee on Communications and Technology is holding a hearing entitled Leading the Wireless Future: Securing American Network Technology.

Due to COVID-19 public health emergency, today's hearing is being held remotely. All members and witnesses will be participating via videoconferencing.

As part of our hearing, microphones will be set on mute for the purpose of eliminating inadvertent background noise. Members and witnesses, you will need to unmute your microphone each time you wish to speak.

Documents for the record can be sent to Joe Orlando at the email address that we provided to staff. All documents will be entered into the record at the conclusion of the hearing.

With that, the chair now recognizes himself for 5 minutes for an opening statement.

Good morning. And first off, I want to thank our witnesses for appearing before us. Today we are talking about our Nation's wireless future and, to some extent, the world's as well. The importance of wireless has never been greater. 5G networks and beyond will grow our economy and enable revolutionary advances in technology and connectivity.

However, as a country and a planet, we face growing challenge. Currently, only four major companies, two based in Europe and two in China, build the equipment and infrastructure essential for these deployments. I am glad to see representatives from three companies working to shake up this industry are here with us today.

We have seen in the United States, Europe, and around the world that lack of competition in this space has divided folks into two camps: Those that can afford secure

networks and those that can't. And as more and more communications and commerce occur via wirelessly connected devices, the security and integrity of these networks has only become more important.

Last Congress, we came together to pass the Secure and Trusted Communications Network Act, to address concerns about the security threats posed by Huawei and ZTE equipment in domestic networks. But that is just the first step. We need national policies that aren't just built for the moment. We need to plan and legislate for the future, particularly in critical and fast-growing areas like 5G and beyond.

It has become clear that lower costs are a driving force for wireless providers to use cheaper Chinese vendors. And as we look at networks in other countries, we can see so many folks struggling with this issue.

Ensuring that the United States and folks around the world have secure networks depends on vendors' ability to be price-competitive with equipment from Huawei and ZTE. That is why I am excited about Open Radio Access Networks, or ORAN. Last Congress, we passed the USA Telecommunications Act, which authorized a range of programs to help accelerate the development and deployment of ORAN technologies.

This technology has the potential to level the playing field and it is already unleashing the power of American ingenuity and competition as well as that of our allies. There are already efforts underway to deploy and integrate this technology into networks in the United States and around the world, but we need to do more and we need to do it faster.

I have talked with a wide range of American network equipment and software companies that want to participate in this growing space. We have the technology, the ingenuity, and the ability to build this technology right here in America.

Our leadership in virtualization and cloud technologies creates tremendous

opportunities for ORAN, and we already design and deploy the most advanced network equipment in the world. However, proprietary interfaces and end-to-end networks built by a single vendor have hampered efforts to apply this experience and expertise to wireless networks. We need to change that.

There are a number of opportunities to fund the USA Telecommunications Act and to expand it. The Biden administration's infrastructure proposal as well as the Senate's forthcoming Endless Frontiers Act both provide opportunities for major investment that can help the United States reassert leadership in this critical sector. I look forward to working with the administration, the Senate, and my colleagues on both sides of the aisle on these important priorities.

Shifting gears, I would be remiss in this discussion about our wireless future and our leadership in wireless if I did not talk about spectrum policy. Spectrum is the fuel that has been powering our Nation's wireless deployments. We have led the way in 4G and we have the opportunity to lead it in 5G, but so much of that will depend on our government's ability to coordinate the use of Federal spectrum and to create pipelines for government spectrum to be made available for commercial use.

Over the last 4 years, we saw too many spectrum squabbles break out between Federal agencies as established norms and processes broke down. It is critical that NTIA play the role given to it by Congress to manage Federal spectrum resources, and the White House needs to make that clear to all Federal agencies and stakeholders.

Ultimately, these are technical issues. And as we have seen time and time again, we can come up with solutions that protect the Federal incumbents' capabilities while at the same time making spectrum available for commercial use. These are issues that are critical to our country, to our economy, and to our Nation's ability to continue to lead the world in wireless innovation.

I want to thank everyone for being here today. I want to thank our witnesses, and I look forward to their testimony.

So, with that, the chair now recognizes my good friend and partner, Mr. Latta, the ranking member of the Subcommittee on Communications and Technology, for 5 minutes for his opening statement.

Mr. Latta, you are recognized.

[The prepared statement of Mr. Doyle follows:]

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Mr. Latta. Well, thank you very much, Mr. Chairman, my friend, for holding today's hearing. I also want to thank our witnesses for appearing before us today on securing our communications networks in the future.

Over the last year, Americans have relied more than ever on broadband technology to earn a livelihood, educate your children, and stay connected with your families and communities.

Wireless connectivity has played a key role. And thanks to the investment and ingenuity of our Nation's wireless providers, U.S. networks rose to the challenge of meeting Americans' unprecedented demand for voice and high-speed data services.

We must continue to build upon our success to remain the global leader in wireless innovation. We must lead in developing 5G and 6G standards and deploying the next-generation 5G technology.

In large part, our leadership depends on ensuring that all generations of networks are secure and on having policies that encourage investment and innovation from trusted companies and the flexibility to bring new technologies to market right here in the United States.

Congress and the Trump administration acted in many ways to protect and diversify our communications supply chain, including funding the implementation of the Secure and Trusted Communications Networks Act to support the removal and replacement of harmful equipment in our Nation's communications networks.

We also worked with our Democratic colleagues last year to enact the bipartisan Utilizing Strategic Allied Telecommunications Act, which created a grant program at NTIA to facilitate the deployment of Open Radio Access Network, ORAN, technologies that would diversify our 5G supply chain, lower equipment cost, and help us to prevent bad

actors like China from disrupting our networks.

It is crucial that Congress fund this grant program and any funding programs that move forward. The use of Open-RAN technology represents one such path to reducing threats. By enabling providers to move away from end-to-end product lines and mix and match vendors inside their networks, Open-RAN can help reduce reliance on foreign equipment and ensure that problematic components of a network's architecture can be easily swapped out.

It will also help trusted suppliers remain economically competitive against Huawei and others seeking to undermine our national security. But more work needs to be done to drive 5G innovation, and we must be forward-thinking in our approach to network security.

Three years ago, this subcommittee held a bipartisan hearing examining the communications landscape, economic competitiveness, and national security. Congress has addressed many of those concerns that we have heard, in large part, because of that bipartisan focus. However, it is clear that we must continue to put a focus on these efforts to preserve American leadership, improve transparency, and information sharing and remain vigilant in identifying new vulnerabilities.

We can start by working together on policies to safeguard America's leadership of standards-setting bodies that are crucial for setting the technical rules of the road for equipment and devices.

We should also work to address the challenges that U.S. and other trusted companies face to compete in a global supply chain and ensure that the work we have already done is being implemented effectively and working as intended, such as NTIA's information sharing program for small and rural communication providers. These are important issues that deserve bipartisan attention. I am grateful for the opportunity to

hear from today's once how we can secure our global 5G leadership.

And one of the great things I have always said about serving on the Energy and Commerce Committee is when we sit up on this dais or virtually sit up on this dais, as we are today, that we look over the horizon 5 to 10 years. And we want to make sure the right laws and the right regulations are being put out there to make sure that our entrepreneurs and innovators can do what they have got to do to make sure that we are the leaders in the world.

So, Mr. Chairman, I appreciate today's hearing. I thank our witnesses for being with us today. And, with that, I yield back the balance of my time.

[The prepared statement of Mr. Latta follows:]

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The Chairman. I can't hear Mr. Doyle.

Mr. Doyle. Can you hear me now?

The Chairman. Now I can yes.

Mr. Doyle. Thank you, Mr. Chairman.

I want to thank my friend for yielding back, and also note that when I was saying ORAN I was referring to Open-RAN also. So I just wanted to make that clear.

The chair now recognizes Mr. Pallone, chairman of the full committee, for 5 minutes for his opening statement.

The Chairman. Thank you, Chairman Doyle.

If the U.S. doesn't lead the wireless future, then rival nations are posed to lead it for us and dominate the 5G marketplace in a way that may undermine our national security and economic prosperity. And China, as we know, has built the world's largest 5G network, and suspect communications provider Huawei currently leads the current market share for 5G base stations.

According to reports, China has more 5G subscribers than the U.S., it has more widespread 5G coverage and its connections are, on average, faster than ours. And this is concerning because history tells us that early adopters and developers define the marketplace, drive innovation, and reap the economic benefits of that leadership.

And as we saw with 4G, the global technological leaders in a given field can define that technology and how it is used. With 4G, we saw the benefits of that in the booming app economy that was created.

We all know the positives and the negatives created by the tech boom. But in this Nation, we have the ability and structures to publicly debate those issues. And when government gets involved, it is in full view of the American people. If the same

tech companies were founded and grew under a more authoritarian regime, the influence of government would be less apparent and potentially much more dangerous.

The Chinese Government's involvement in Huawei and ZTE has raised security concerns with their equipment. We also have seen how China places restrictions that undermine privacy, security, and intellectual property interests on American companies entering the Chinese market.

And based on past experience, the Chinese Government cannot be trusted to set the standards that govern our wireless future. Instead, we must help our own Nation and like-minded democracies once again lead in technological innovation and preserve a secure and free marketplace.

And to this end, we have already made progress. We have funded the Secure and Trusted Communications Network Act to the tune of $1.9 billion to replace all suspect equipment in the U.S. We also enacted the Secure 5G and Beyond Act to require the executive branch to formulate a whole-government strategy to protect our 5G networks.

And I am also encouraged by President Biden's focus on expanding U.S. leadership. The administration's support of Doreen Bogdan-Martin to lead the International Telecommunication Union demonstrated a commitment to a more inclusive and sustainable global digital landscape.

And just last week, President Biden welcomed Japanese Prime Minister Suga to the White House, where they agreed to work jointly on the rapid development of 5G technologies. And in that vein, we acted the USA Telecom Act last year to help fund the promotion of Open-RAN networks that can be used to finally bring the United States and more of our allies into the business of manufacturing network equipment.

Congress must nevertheless fund this legislation so we can promote and deploy

this critical technology to create American jobs here at home and building the networks of the future.

We also need to make sure that all providers, including small providers and communities, have the resources and technical assistance to leverage this technology, but we can't stop there. We need to leverage our Federal agencies to review the security issues presented by consumer equipment, especially equipment produced in suspect countries.

And we must also quickly address the Trump administration's failure to appropriately coordinate across our government to make our airwaves available for these new technologies. It is important that we work together to put our airways to the best possible use while addressing legitimate safety concerns.

I would like to yield now the rest of my time to the gentlewoman from California, Ms. Matsui.

[The prepared statement of The Chairman follows:]

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Ms. Matsui. Thank you very much, Mr. Chairman, for yielding to me.

While we are still in the early stages of 5G deployment, the Federal Government must be a driving force in spectrum policy if we are to win the race to 5G and beyond. That is why I wrote then-President-elect Biden 4 months ago, urging him to adopt a unified approach to spectrum policy and a clearly articulated process for resolving interagency disputes.

Over the past 4 years, significant conflicts between Federal agencies caused costly delays in making new spectrum available, while also creating severe uncertainty for government and industry.

Moving forward, I look forward to seeing NTIA resume its role as manager of the Federal Government's use of spectrum. We must also take steps to support a secure and diverse supply chain. As original cosponsor of the USA Telecommunications Act, I believe we need to fully fund the programs that bill to support the development and deployment of Open-RAN.

I think the funding authorized by our bill should serve as a floor, not a ceiling. Recently, a bipartisan group of Senators called for an increase in funding to $3 billion, and I hope this chamber can find bipartisan compromise to keep pace.

Thank you, Mr. Chairman, for yielding to me, and I yield back. Thank you.

[The prepared statement of Ms. Matsui follows:]

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Mr. Doyle. The gentlewoman yields back.

The chair now recognizes Mrs. Rodgers, ranking member of the full committee, for 5 minutes for her opening statement.

Mrs. Rodgers. Thank you, Mr. Chairman.

Good morning, everyone. I too want to join in thanking our witnesses for coming and being with us today on the Energy and Commerce Committee. America's global leadership and ability to win the future depends on our capacity to harness the wireless technologies that will help shape our Nation and the world in coming decades.

Networks will continue to get faster, stronger, and connect more people and devices than ever before. We are already preparing for many life-altering and even life-saving benefits of 5G, from enabling autonomous vehicles and the Internet of Things to improving access to remote healthcare services, including life-saving remote surgery, to empowering farmers to increase crop yields and fight hunger through precision agriculture.

And 5G promises to integrate our lives even more with the digital world. 5G and future generations of wireless networks will help fuel innovation and entrepreneurship and help connect millions of Americans, which is why they must be secure.

We must make certain that America, not China, is capturing this innovation as well as developing and eventually deploying these technologies. We do not want countries like China making the rules and leading in technologies like 5G and 6G that could give them so much control over American lives and industry.

The more we rely on communication infrastructures in our daily lives, the more critical it becomes to ensure our network is secure from those who seek to do us harm. We recognize the potential threats that have come from not only having a robust and

secure supply chain, and we need to find solutions.

We already have a track record of unity on this committee and success on these issues. Our bipartisan work in the last Congress helped fund the removal and the replacement of untrusted equipment through the Secure and Trusted Communications Networks Act.

We also came together to catalyze the development and the deployment of Open-RAN compatible technologies by passing the USA Telecommunications Act. It established a grant program for deployment of Open-RAN capability technology in our networks, and I urge for that to be funded quickly to spur the development of a robust, trusted equipment marketplace.

And that is just the beginning. As we remove untrusted equipment from our domestic networks, we must look to the future and consider what the availability of trusted vendors will be in years to come. As our mobile networks advance, we also must make sure regulations don't hold back new technologies that have the potential to improve our quality of life and secure America's leadership.

Cloud-native networks can help push software and security upgrades more quickly than their predecessors and help speed the transition to 5G and operators that use them. Multi-Edge computing and networks bring new opportunities.

As the Chinese Communist Party seeks to control our technological future, it is critical that we encourage trusted companies to participate and lead in international standards bodies and make sure Americans are at the helm of these organizations, Americans like Doreen Bogdan-Martin, candidate for Secretary-General of the International Telecommunication Union. And I also support her. She would be the first woman and the first American in a long time.

Mr. Chairman, I am pleased to join together in supporting her. She shares our

values of openness, transparency, and connectivity for all.

And with that, I just want to say thanks for holding this important and timely hearing. I yield back.

[The prepared statement of Mrs. Rodgers follows:]

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Mr. Doyle. The gentlelady yields back and I thank her for her opening statement.

Now I would like to introduce our witnesses for today's hearing: Ms. Diane Rinaldo, executive director, Open RAN Policy Coalition; Mr. John Baker, senior vice president, business development, Mavenir; Mr. Tom Donovan, senior vice president, legislative affairs, for the Competitive Carriers Association; Mr. John Mezzalingua, chief executive officer, JAM Wireless; and Mr. Tareq Amin, executive vice president and group chief technology officer, Rakuten Mobile.

We want to thank our witnesses for joining us today. We look forward to your testimony.

At this time, the chair will recognize each witness for 5 minutes to provide their opening statement, and we will start with Ms. Diane Rinaldo. You are recognized for 5 minutes.

STATEMENTS OF DIANE RINALDO, EXECUTIVE DIRECTOR, OPEN RAN POLICY COALITION; JOHN BAKER, SENIOR VICE PRESIDENT, BUSINESS DEVELOPMENT, MAVENIR; TIM DONOVAN, SVP, LEGISLATIVE AFFAIRS, COMPETITIVE CARRIERS ASSOCIATION; JOHN MEZZALINGUA, CHIEF EXECUTIVE OFFICER, JMA WIRELESS; AND TAREQ AMIN, EVP AND GROUP CHIEF TECHNOLOGY OFFICER, RAKUTEN MOBILE

STATEMENT OF DIANE RINALDO.

Ms. Rinaldo. Thank you so much, Mr. Chairman, as well to Ranking Member Latta, full committee Chairman Pallone, ranking member full committee McMorris Rodgers, and members of the committee.

On behalf of the 60 members of the Open RAN Policy Coalition, I would like to thank you for holding this important and timely hearing today. My name is Diane Rinaldo, and I have the pleasure of serving as the executive director of the Open RAN Policy Coalition, a coalition that not only spans the globe but also the mobile ecosystem.

We are a diverse group of information and communications technology companies that have a common goal of breaking down technological barriers to promote a varied and competitive wireless marketplace and create a future in which radio access network architecture is based on a more modular design with open and interoperable interfaces.

Our coalition members include carriers, vendors, cybersecurity providers, tower operators, cloud providers, innovators, startups and legacy tech companies that have come together because they understand the health of the entire ecosystem is reliant on a secure, robust, and diverse supply chain. We have been working together for nearly a year to educate policymakers across the globe on the benefits of Open-RAN.

Today, I look forward to discussing the reasons why we believe that Open-RAN will provide significant public interest benefits, namely driving increased competition, providing technologic improvements, making services and products more affordable for consumers, including those in rural and underserved communities, and serving as a complement to parallel advances and enhancing network security and network management of 5G.

The world is on the precipice of the fourth industrial revolution that will be driven by advanced wireless communications. While these advancements will require a faster and more resilient network to flourish, the continued growth of telecommunications networks is also predicated on certainty and stability within the supply chain.

This certainty is currently in question. The small pool of existing vendors for wireless network build-outs has fueled concerns over supply chain resiliency and competition. Network operators are left with a limited choice for next-generation networks, posing economic risks and creating barriers for smaller firms in the 5G space.

We are seeing firsthand that disaggregating the radio access network lowers the barrier to entry for new vendors in the marketplace. Increased vendor choice, in turn, drives competition and innovation, which will lead to lower prices.

Fortunately, the United States, its partners, and the communication companies that serve those markets have reached an inflection point in the development and deployment of Open-RAN. In short, this technology is not only ready for prime time, but is actively being deployed in the commercial communications ecosystem, thereby advancing the national interests of the United States and partners.

I want to applaud the hard work done by this committee and staff with the introduction and passage of the USA Telecommunications Act last year. Fully funding the two programs at $3 billion will help bolster advanced wireless networks and future

our telecommunications system. I would also like to add that NTIA is the right agency to be administrating this program, but I promise that I have no biased opinions on that.

Additionally, I would like to commend the recent bilateral engagement of President Biden and Japanese Prime Minister Suga. The realization of Open-RAN being a common advancement for our two nations is further proof that collaborative approaches in technology is good policy.

Promoting diversity and security in the 5G supply chain is of global interest and will require a common solution. The challenge for policymakers today revolves around a central question: How can we use competition and innovation to drive the next generation of networks?

In order to promote this technological evolution and accelerate a stable, sustainable, and successful transition to 5G and beyond, government initiatives and policy priorities must support new and existing technology suppliers as well as small and large network operators offering open and interoperable RAN solutions as well as integration of those open components, create a competitive global ecosystem of diverse and trusted suppliers and service providers, and encourage building, maintaining, and investing in U.S. and technological allies leadership for the deployment and development of both 5G and future wireless networks.

The United States is at a critical juncture. The issues that we are discussing today and which reside under your jurisdiction no longer pertain only to telecom policy, but also to economic policy and economic security. As we move to the digitization of everything, mobile networks are the lifeblood of our ecosystems. Ensuring a healthy supply chain has never been more important, and working with our allies to sync on these issues has never been more critical.

Thank you again for your continued work on this issue, and I look forward to

participating in this hearing.

[The prepared statement of Ms. Rinaldo follows:]

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Mr. Doyle. Thank you, Ms. Rinaldo.

The chair now recognizes Mr. Baker for 5 minutes for his opening statement.

STATEMENT OF JOHN BAKER

Mr. Baker. Thank you, Chairman Doyle, Ranking Member Latta, Chairman Pallone, and Ranking Member McMorris Rodgers. Thank you for the opportunity to appear before you today.

My name is John Baker, and I lead the 5GT at Mavenir. Mavenir is a U.S.-headquartered company founded 16 years ago. We are a trusted software vendor for the U.S. mobile operators, serving more than 250 operators around the world.

We are also a pioneer in providing solutions using open interfaces, including radio access networks, known as Open-RAN. We have Open-RAN deployments in India, Germany, the United Kingdom. In the United States, we are helping Dish build the Nation's first standalone 5G Open-RAN network.

Today's hearing comes at a critical time for the mobile network supply chain. Because of industry's consolidation and the banning of untrusted vendors, two companies supply nearly 100 percent of the United States' radio access networks. These companies, both headquartered overseas, provide proprietary RAN products that lock out other suppliers, limiting competition and narrowing the supply chain. However, there is a solution, and that is called Open-RAN.

Today I will focus on three points: One, how Open-RAN will help build a more robust and diverse supply chain; two, why interoperable standards will help the U.S. lead in 5G; and three, how the U.S. Government can help support Open-RAN deployments.

Firstly, Open-RAN will help build a more robust and diverse supply chain. To be clear, Open-RAN is not a technology but, rather, a shift in how we design and build mobile networks, using interoperable subcomponents from multiple vendors.

The current RAN market in the United States is a prized one. We have the highest margins and profitability globally. But at the same time, it is limited to two incumbents who have locked up the market with proprietary systems.

In contrast, the Open-RAN ecosystem numbers more than 60 companies, including several U.S. suppliers, such as Dell, Intel, JAM Wireless and Mavenir. Open-RAN not only supports a diverse supply chain, but also brings significant cost savings, increased security, and future-proof networks. An important benefit is that rural carriers undergo a taxpayer funded rip and replace.

Secondly, advancement of interoperable standards will help the United States lead in 5G and beyond. For the U.S. to lead in next-generation networks, Congress must facilitate U.S. participation in international standards. Global standards for mobile technologies are set by 3GPP, which used to support open interfaces. However, the dominant manufacturers now control the standard-setting process, which means the current global standards foster proprietary products and limit the global supply chain.

To help advance interoperability, more U.S. companies need to participate in 3GPP, but participation is expensive. To increase U.S. participation in setting these important global standards, the United States should work more closely with industry and financially support involvement in 3GPP. Without more United States companies at the table, we are at the risk of being eliminated completely in the U.S. RAN market.

Finally, the United States Government must take further action to support Open-RAN. Around the world, allied nations are advancing aggressive policies to build their next-generation networks with Open-RAN. Five major European operators have

committed to deploy Open-RAN, but some are preparing local suppliers. But sadly, the full embrace of Open-RAN has not happened in the United States.

To help advance Open-RAN and ensure a diversified supply chain, we strongly recommend three actions in the United States Government: Firstly, we must fund the public Wireless Supply Chain Innovation Fund. Last year, thanks to the leadership of this committee, Congress created a crucial grant program to help companies like Mavenir scale, reshore manufacturing of network components, and advance U.S. standardization leadership. Congress should quickly appropriate the requested $3 billion for this fund.

We also promote competition in the supply chain. While there are no dominant U.S. companies selling into the 5G equipment market, there are many vying to engage. The best way to engage leadership as a core industry is to encourage competition fostering Open-RAN.

Lastly, the United States Government can provide financial incentives like loan guarantees and tax incentives to propel our mobile operators to pursue Open-RAN. This will help small companies scale and have the ability to compete with the dominant incumbent suppliers.

Thank you and I look forward to your questions.

[The prepared statement of Mr. Baker follows:]

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Mr. Doyle. Thank you, Mr. Baker.

Now the chair recognizes Mr. Donovan for 5 minutes.

STATEMENT OF TIM DONOVAN

Mr. Donovan. Chairman Doyle, Republican Leader Latta, and members of the subcommittee, thank you for the opportunity to testify about how the United States can lead the world in future wireless services.

CCA is the Nation's leading association for competitive wireless providers, representing carrier members ranging from small rural providers serving fewer than 5,000 customers to regional nationwide providers serving millions of customers, as well as vendors and suppliers that provide products and services throughout the wireless communications ecosystem.

Wireless communication services have become inextricable parts of our lives, with functionality that has experienced tremendous growth from the humble roots of the first mobile phone call placed 48 years ago this month. Americans now have an average of 1.3 mobile devices per person and use those devices not only to place calls and send texts, but to work, learn, monitor health, connect to public safety and access millions of applications.

Through American leadership, the jobs and growth powered by the wireless industry and the application economy have been centered here in the United States. America's continued leadership as the industry advances to fifth-generation networks will be crucial to support continued innovation and economic growth.

To lead the wireless future, we must focus on three critical pillars: Mobile

infrastructure, access to secure equipment and devices, and a unified spectrum strategy.

First, infrastructure. At a foundational level, the United States cannot lead the wireless future without ubiquitous advanced wireless services for all Americans.

As you consider generational investments in infrastructure, I applaud the bipartisan support for broadband, based on reliable maps. Expanding the fiber footprint will advance connectivity and provide backhaul needed to expand wireless coverage and speeds.

But a generational investment in digital infrastructure that focuses on fixed broadband alone will be incomplete. Simply put, there are exciting and important innovations and services that rely on wireless connectivity and cannot be supported through fixed broadband technology at any speed.

As wireless services continue to develop, some of the greatest potential for 5G technologies exist beyond consumer use. And while the most transformational services that will depend on mobile broadband may not even be invented today, we do know this: Mobility will continue to be a catalyst for economic growth in rural America, and any infrastructure efforts that do not ensure ubiquitous mobile broadband could create a new digital divide of technology denial.

Second, equipment must be available and secure. CCA commends this committee for its focus on network security, including passing and funding the Secure and Trusted Communications Networks Act. While the FCC has worked diligently to implement the program, participating carriers may struggle to lock in plans to move forward, due to uncertainty regarding the final application process, structure and timing of reimbursements, and other decisions that will be made by the FCC in the coming months. CCA encourages further transparency and guidance so that all stakeholders can efficiently complete the replacement and removal of covered equipment.

Completing the program is a critical priority, and a broader look at the equipment market can help ensure sustainable alternatives to equipment and services deemed to pose a national security threat. This includes research and development, and CCA urges Congress to fully fund the programs created through this committee's bipartisan leadership and the USA Telecommunications Act. As that legislation recognizes, ORAN presents exciting new potential to disaggregate functionality to increase competition and reduce costs.

The prospect of introducing new vendors into the ecosystem has tremendous potential benefits, but policymakers should not mandate specific technologies. If new technologies like ORAN live up to their promise, they will succeed in the marketplace. Meanwhile, carriers will continue to rely on existing trusted vendors.

Third, we must have a unified spectrum strategy. With increased wireless use, spectrum needs will only accelerate. These needs will be met, in part, from spectrum that is reallocated from Federal users. As a timely example, the 3450 to 3550 megahertz band, which the FCC plans to auction later this year pursuant to your directive, will involve sharing between incumbent Federal users and new commercial operations. For that auction to be successful, industry needs more information about exactly where and how the spectrum will be available and needs that information now.

Unfortunately, there are too many recent examples where NTIA and FCC adopted science-based spectrum policies that were questioned after the fact, even after auctions have been completed, including in the C-band, 24 gigahertz band, L-band and 5.9 gigahertz band. Congress must take steps to restore trust in the process, ensuring NTIA is the voice and authority for spectrum management and use across the Federal Government, just as the FCC is for commercial use.

In closing, mobile wireless infrastructure, secure and innovative wireless network

equipment, and effective spectrum coordination and management across the government are three elements critically important for the United States to lead the wireless future. Thank you for your leadership on these issues and holding today's hearing, and I welcome any questions you may have.

[The prepared statement of Mr. Donovan follows:]

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Mr. Doyle. Okay. Thank you, Tim.

Next, we will recognize Mr. Mezzalingua.

You are recognized for 5 minutes, sir.

STATEMENT OF JOHN MEZZALINGUA

Mr. Mezzalingua. Thank you. Chairman Doyle, Ranking Member Latta, Chairman Pallone, Ranking Member McMorris Rodgers and other distinguished members of the subcommittee, thank you for inviting me to testify.

My name is John Mezzalingua. I am the CEO of JAM Wireless and I am honored to be here today. We are grateful for all that Congress and the administration are doing to promote the adoption of 5G in the U.S. and the transition to ORAN.

We are at an inflection point in both our industry and our country. As the world transitions to 5G and ORAN, technology, market, and political forces are aligning to create a new era in communications. The policy choices we make now will determine the new global leaders in this industry.

I am here today because I believe we have the opportunity to bring leadership in this industry back home. Technology designed in the U.S., manufactured in the U.S. by American companies will help secure our supply chain, promote high-speed internet for all Americans, and transform how businesses operate, all while creating jobs.

We are in the early but critical stages of this transformation, and we believe that government has a meaningful role to play in helping the American people realize the potential benefits.

JMA is an American wireless technology company based in Syracuse, New York.

We design and manufacture products only 30 yards away from where I am sitting right now that are deployed on virtually every cell tower in the country.

But more to the point of today's hearing, we are also designing and manufacturing advanced software network-based solutions that are beginning to have a revolutionary impact in the transition to 5G for carriers, businesses, and government. This technology is ORAN compliant. It is disrupting the marketplace, and we believe it will play a major role in restoring U.S. telecom leadership.

We currently employ about a thousand people globally, with facilities in six cities across this country, including Syracuse, Dallas, Austin, Chicago, Boulder and Richmond. In an opportunity zone in downtown Syracuse, we are building the country's first U.S.-owned 5G campus, including a smart factory with production to begin this fall.

Now, others on this panel have spoken about the benefits of ORAN. What unlocks the real magic of ORAN is when you take what has been done in hardware and do it in software. We refer to this as virtualization, and it is the key to restoring American leadership.

This is not pie in the sky stuff, it is happening now. For example, JMA is deploying a wireless network to the city of Tucson that in its first phase provides high-speed internet to 5,000 households and businesses, largely in school districts most affected by the digital divide. Using CARES Act funding for this project, Tucson is now poised to become a world-class connected city.

We have been talking about the digital divide in America for decades. This is the time to finally solve it, with U.S. companies providing the latest technology. Other cities are following Tucson's lead already.

JMA was also selected by the Pentagon as a supplier for a 5G testbed at the Marine Corps facility in Albany, Georgia, as part of an all-U.S. team that includes Amazon,

Cisco and Federated Wireless. JMA is deploying our software-based RAN solution for a 5G network which will support warehouse robotics, bar code scanning, and virtual reality applications. As these examples suggest, we are making real progress, and we believe the right policies can go a long way to securing and accelerating U.S. telecom leadership.

We have the following suggestions: First, focus on U.S. manufacturing. We are proud of our American roots as an innovator and U.S. manufacturer, but we are up against foreign competitors who benefit from industrial policies that give them unfair advantages.

We believe our government should enact policies that promote American innovation while staying true to our international obligations of fair play. For example, projects funded by American taxpayers should be awarded to domestic manufacturers.

Second, funding the USA Telecom Act. We commend Chairman Pallone, Representative Guthrie, Representative Matsui and many others in Congress for pushing this forward. Now it needs to be fully funded.

Third, the additional funding for broadband access. We encourage Congress to continue finding ways to fund this critical infrastructure so no American is left behind.

Last, additional spectrum. We encourage the administration and Congress to work together to maximize the amount of spectrum available.

Thank you for your time. I welcome your questions.

[The prepared statement of Mr. Mezzalingua follows:]

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Mr. Doyle. Thank you very much.

The chair now recognizes Mr. Amin for 5 minutes for his opening statement.

STATEMENT OF TAREQ AMIN

Mr. Amin. Good morning. Thank you for the opportunity to testify to you today. My name is Tareq Amin. I am the group chief technology officer for Rakuten, and I am honored to be here with you today.

To start, let me say Rakuten doesn't think of itself as a mobile operator. We are, indeed, a technology company with both Japanese and American DNA, bringing the best of what the technology sector offers to advance the agility, security, and affordability of our wireless network and services. In fact, Rakuten Mobile is its own first customer. Running on our open cloud-based Rakuten Communications Platform, or RCP, our mobile network in Japan proves that open and cloud-based wireless networks are no longer a proof of concept. Today they are, indeed, a reality.

We are driving a more diverse supply chain with continuing innovation across multiple technologies, and providing significant consumer benefits. The majority of our network components today comes from U.S. suppliers. We have collaborated with companies like Intel, Qualcomm, and Cisco to create this open network ecosystem.

When I joined Rakuten, I was optimistic that they would give me the opportunity to do something for the wireless industry that is well overdue: To reimagine the network end to end, from radio to transport to the core and support systems, leveraging the internet and cloud principles.

When we started this journey, Rakuten, indeed, had a choice, to select a

traditional vendor or to bring the ethos of the technology sector to telecom. In fact, the behind-the-scenes story at Rakuten is that we did consider going with a Chinese equipment supplier.

One of my first jobs at Rakuten was to cancel the ongoing RFP process and reimagine how future networks should be built and the possibility that networks could become more secure. And we knew that for this network concept to become credible, an ecosystem needed to be created.

Historically, wireless networks relied on a small number of vendors to provide complete vertical solutions from radio to the core and other parts of the network. It has always been about replacing proprietary hardware with new proprietary hardware, and it was never about software.

While the model has evolved somewhat, but the reality from its early days is that now only a handful of mobile network vendors still exist. In order for our model to come to light, we had to find the right partners.

For example, in 2018, we reached out to Nokia and asked them to sell us the radio hardware parts of their complete solution so that we could use them with our software-based Open-RAN platform. It took significant courage for Nokia to agree to unbundle the radio, but, to their credit, they did. And from there, we invested very heavily in a U.S.-based startup called Altiostar to work with Nokia and enable a deployment of a true cloud-based network concept in Japan.

I personally wanted everything to be open so that we could dictate how we monitor this network, how we apply security, whether to components, software or even hardware itself. That is something in which we made a cognizant choice.

That choice enabled Rakuten to have more visibility and control points in our network, because we are not beholden to one vendor. The various parts of this network

provide a needed check to each other to help keep the overall system more secure. The system has also the benefits of allowing us to better isolate problem areas and prevent them from contaminating other parts of the network.

This last point is what brings us here today, because Rakuten chose to move to a more open, software-centric, cloud-native architecture. And to this extent, we are able to innovate at a more granular level. We are relentlessly automating our network, and we are driving a more diverse supply chain. We believe we are better equipped to secure our network, and we are driving costs down. We are proud to be an inaugural board member of Open RAN Policy Coalition and a member of Competitive Carriers Association.

Rakuten is committed to work with the U.S. Government and industry stakeholders to serve the American market. However, U.S. leadership will be critical if we are to succeed on a larger scale. To this end, I offer three suggestions for how U.S. Congress can continue to drive innovation and security in wireless networks.

First, the U.S. Government should actively promote open and cloud-based technology for telecom networks, through its policies and international engagement. The Japanese Government have been incredibly supportive of our approach. And the open and cloud-based communication ecosystem is the wave of the future, but it is young and needs to be cultivated and nourished if it is to grow. American leadership is imperative to advance this important evolution.

Second, Rakuten urges Congress to provide positive incentive for American companies to embrace an open and cloud-based future.

And finally, Rakuten urges Congress to fund the USA Telecommunications Act, and I would like to thank this committee for your leadership on that bill. Chairman Pallone, I support your efforts to fund this program at a significant level in order to drive innovation

and deployment in open and cloud-based systems. And I urge your colleagues to join you. Nothing less than American competitiveness is at stake.

Thank you very much, and I look forward for your questions.

[The prepared statement of Mr. Amin follows:]

******** COMMITTEE INSERT ********

Mr. Doyle. Thank you, Mr. Amin.

And I want to thank all of our witnesses today for their excellent opening statements. We have concluded the openings. We are now going to move to member questions.

Each member will have 5 minutes to ask questions of our witnesses. I would ask all of my colleagues to stick to that 5-minute rule, and don't be asking a question with 2 seconds left. We are going to try to keep members to that.

And I will start by recognizing myself for 5 minutes and hopefully setting an example for how the rest will ask their questions.

Let me start with Mr. Donovan. While Open-RAN technology holds a lot of promise, many of your members have relied on larger equipment vendors to help with systems integration, maintenance, and troubleshooting.

What additional steps can Congress take to ease and accelerate the adoption of Open-RAN amongst your members?

Mr. Donovan. Thank you for the question. So when we recently surveyed our members, we found that 37 percent of our carriers are already working with a systems integrator, but 100 percent of those responded that they are utilizing network optimization and analytics tools.

So it goes to show that if this technology can live up to the promise, there is a huge market potential for it. Some things that Congress can do to help with that is working with regional hubs and setting up additional technical assistance so that carriers that may not have some of this in-house are able to get additional education and the efforts that they need to be able to take part in this.

Mr. Doyle. Thanks. Mr. Baker, your company has worked with wireless

telecommunication companies across the globe to bring a lot of benefits of cloud and virtualization to bear on their networks. How would additional Federal resources help speed the deployment and adoption of Open-RAN here in the United States?

Mr. Baker. Thank you, Chairman Doyle. The additional funding will help get the Telecommunications Act funded so that we can actually scale the companies to actually support these networks, both from system integration, also refunding the growth of mobile equipment companies, bringing technologies back from China.

One example of that is the radio technology. There is not a U.S. radio company where you can go buy frequency balance with the U.S. market that is open to Open-RAN type solutions. So it will support U.S. manufacturing jobs and critical components and ensure that U.S. companies are involved in servicing the next-generation networks.

Mr. Doyle. Thank you.

Mr. Amin, what has Rakuten's experience been with developing and deploying its Open-RAN network? What kind of advantages have you seen versus using a traditional vendor?

Mr. Amin. Thank you, Congressman. Well, firstly, I must say that for us, when we looked at how we need to construct and build this network, it was very clear for us that the United States had one of the most advanced technology building blocks that we require to build an open network, open platform architecture.

In the early days, of course, this journey was not simple and easy for us to accomplish. However, the advancements that we have seen when it comes to scaleable automation, cost reduction, agility and speed have been significant. And we went from the early days where this technology being debated. Today, I think the merits and the capability and the technical merits of it is being celebrated.

And thanks to the partners and the ecosystem that we created, I always say that

we are scratching the surface of what is possible to enable autonomy in mobile networks.

Mr. Doyle. Thank you.

Ms. Rinaldo, are your members concerned about supply chain issues related to chip shortages, and how could it impact their ability to get wireless products and services to markets?

Ms. Rinaldo. Thank you, sir. Yes, the Open RAN Policy Coalition, just like so many other manufacturing industries around the world, are concerned about the shortage of chips. We are supportive of funding to bring back manufacturing and to boost that in the United States, in order to help not only our own supply chain but that of our partners. It is something that we are following, and we stand ready to help however we can.

Mr. Doyle. Thanks. How about you, Mr. Donovan, how is that affecting your members?

Mr. Donovan. Anything that increases the costs or delays the access to that equipment is going to have an impact on several of the programs that we have talked about today, from removing covered equipment from carriers that do have it in their network to upgrading to 5G. So anything we can do to make sure we have a steady supply chain and availability is something that we would support.

Mr. Doyle. Well, thank you very much to all the witnesses. The chair is going to yield back 45 seconds and recognize the ranking member of the subcommittee, Mr. Latta, for his 5 minutes. Mr. Latta, you are recognized. Bob, I think you need to unmute. Bob, we still can't hear you. Bob, are you able to unmute? Can you hear me?

I think maybe we will go to Mrs. McMorris Rodgers and come back to you, Bob, once we figure out how to get your system unmuted. Is that okay?

Mrs. Rodgers. Then I need to unmute.

Mr. Doyle. Okay.

Mrs. Rodgers. Are you unmuted now, Bob?

Mr. Doyle. Cathy, why don't you go ahead for your 5 minutes, and we will come back to Bob once he gets that taken care of.

Mrs. Rodgers. Okay. Sounds good.

Again, thank you, everyone, for joining us today. Despite all the great bipartisan work that this committee has done to help secure our communication supply chains and safeguard our technology leadership, China remains a constant threat when it comes to our privacy, intellectual property, and national security. One crucial part of securing our competitive edge involves U.S. and trusted companies participating in 5G standard-setting bodies like 3GPP.

Three years ago, under Republican leadership, this committee held a bipartisan hearing that examined our supply chain security. And we heard from experts on the need to bolster private sector leadership and close collaborative engagement with government partners through clear and effective processes.

Ms. Rinaldo, I wanted to ask you, what actions do you believe the United States should be taking to improve its public and private sector representation at these bodies, and what other actions can we take to bolster the trusted vendor marketplace and prevent China from seizing control of global 5G supply chains?

RPTR GIORDANO

EDTR HUMKE

[12:26 p.m.]

Ms. Rinaldo. Thank you, Ranking Member.

Yes, I agree with you. We need more participation not only on the U.S. Government end, but also in the private sector. I think one important step to take is to formalize more processes. We need to permanently designate a U.S. Government lead at 3GPP.

I understand that Congressman Johnson has introduced a bill in the past, but let me -- I have -- designated NTIA as the lead actually. Let me tell you why that is important.

During my time at NTIA, we had an interagency process which eventually tapped an individual at NTIA as the government lead. We need to formalize these processes.

While you often hear that foreign adversaries are in -- at standards bodies with thousands of people, that is not making the difference. What is making the difference is that they are more coordinated. We need to formalize these processes. We need to nurture these expertise at a certain agency. I would say that NTIA, with their expertise on telecom, is the agency to select.

And then we need to examine the rules how the United States Government and private sector can come together to better coordinate on these issues. There are rules in the way, whether it be antitrust -- the United States Government has to form a FACA, a Federal advisory committee, in order to have conversations. There are hurdles and barriers in the way to having these talks.

The more that we discuss it and are forced to deal with these barriers, the less we are talking about the issue at hand. I think it would be smart for Congress to look at the

barriers in place, figure out what is needed, what is not, and how to best move forward.

Again, participation is of the utmost importance in going to the future. And, again, just learning from lessons learned in the past.

Mrs. Rodgers. Thank you for those insights.

It seems like everyone on this committee is really excited about the development of Open RAN-compatible technology, and it is showing great promise. Rakuten Mobile has already deployed commercial networks using Open RAN architecture.

Mr. Amin, what are the biggest challenges that you faced, and what are some of the lessons that you have learned so far? And then I would also like to ask if you would just speak to the role that government played in helping complete the project.

Mr. Amin. Thank you very much, Congresswoman.

I think, when we started early on, a lot of people thought that our biggest challenge is about the technology. Actually, it was quite the opposite of this.

Our biggest challenge was about mind set, mentality, and determination to hire the right organization, to build the right people that are willing to do the impossible. And, to pull these pieces together, initially, we had to take a much larger role on what the industry now is calling a system integration.

We learned quickly the importance of pulling these pieces of the puzzle together, but it was, from our point of view, very doable, and something that we needed to do in order to push the advancements in this technology in Japan, to enable cloud-native architecture to come to reality. So I would say the first biggest lesson is to put the integration processes in places, and then, furthermore, as time advances, to minimize the level of complexity in system integration, if not eliminate it.

The second thing is about understanding the criticality of cloud-native architecture, the beauty of cloud, and the constant economics that you can bring in.

And the third, which cannot be also underestimated, the importance of having the right ecosystem and the right willing partners. And we were so pleasantly surprised to see the embracement from all the executives of the various entities in the U.S. that we worked with. That was extremely welcomed, to all our benefit and the benefit to the consumers of course in Japan.

So I would say we are extremely optimistic and think really the future of such technology is imminent if we continue to work and collaborate to embed this in our DNA from a technology organization.

Mrs. Rodgers. Thank you very much.

Mr. Doyle. Gentlelady's time has expired.

The chair now recognizes Mr. Pallone, the full committee chair, for 5 minutes.

The Chairman. Thank you, Chairman Doyle.

I was going to start with Mr. Donovan.

In your written testimony, you argue that we should take a broader look at the equipment market to help ensure sustainable alternatives to equipment and services that deem -- that could pose a national security threat. And we have some of the companies that will help us do that on the panel today, and there are others like Airspan and our longtime partners in producing secure networks, including Ericsson, Nokia, and Samsung.

So my question is: What have your members told you about how they handle technical problems in their networks when they arise, and do you have any thoughts on how we might make that troubleshooting easier for them?

Mr. Donovan. Well, thank you for that question.

You put your finger on one of the top issues that our members have been talking about as they are discussing some of these evolutions. And, to my colleague's point in answering the last question, that this is why the systems integration piece is so

important. And, when you are with one vendor end to end and something goes wrong with the network, that is who you call.

As conversations continue with a range of different equipment providers, there needs to be confidence on the side of the carrier that, if something goes wrong, there is one person that they can call, and they can help them identify where the problem is, especially if there are different -- different equipment from different companies involved throughout the stack.

So that is something that we are continuing to evaluate. It is a hot topic for discussion amongst my members, and ensuring trust in that process is going to be important for adoption of some of these technologies.

The Chairman. Well, let me also ask you -- I mean, as you know, for some time on the committee, we have raised concerns about the security of our network-connected consumer equipment. Are there ways that we can use some process at the FCC and elsewhere to help address the potential risks of that?

Mr. Donovan. So yes. So the FCC already has a role in approving equipment to be used on the networks in terms of the RF side. We continue having conversations about if there is a role for the FCC or other Federal agencies in, you know, providing approval and certification on the security side, especially with the massive amount of growing numbers of devices that are more than just the smartphones that we carry around, to make sure that all devices that are connecting to the networks are secure.

The Chairman. Well, thank you, Mr. Donovan.

Let me go to Mr. Baker.

I have heard some controversy regarding whether Open RAN is really ready for prime time. I think it is, but I am interested in your views. So let me just ask: Is Open RAN technology ready for prime time and network deployments, and what will that mean

for jobs here in the U.S.?

Mr. Baker. Absolutely, Open RAN is ready. It is being deployed. We have got members on the panel here today that are deploying it. And, you know, as a result, you know, jobs will -- you know, will increase, and, you know, the business, through innovation and technology, will grow the ecosystem.

I think one comment I would like to make is that the whole issue that we are really trying to address is one about open interfaces and ensuring, through the standardization process and, you know, putting enough people into the standardization process -- and, again, that is sort of job creation, but they are really focusing down on the root cause of the problem, which is open interfaces with interoperable products.

The Chairman. All right. Thank you.

Well, Mr. Baker, let me ask you another question.

Last Congress, we passed the USA Telecommunications Act, you know, which supports security and competition in wireless network marketplace through the deployment of Open RAN technology. But, as I think has been mentioned, that act still needs to be funded.

So do you believe that funding the USA Telecommunications Act will promote alternatives to Huawei and ZTE equipment, as well as competition? And, of course, what level of funding do you think we need?

Mr. Baker. Yeah. Thank you, Congressman Pallone.

Yes, absolutely. You know, funding that will -- is the first step. The second step is actually to put policy and process in place that actually directs the money to their correct places to grow the ecosystem. You know, we see on the Rip and Replace Act, for instance, that money is diverted, because of timelines, back to existing, you know, proprietary suppliers.

So, you know, policies should direct the money to the companies that need to scale and grow this Open RAN ecosystem.

The Chairman. Do you want to give us -- give it a shot at the level of funding that --

Mr. Baker. Yes. I certainly think, you know, that --

The Chairman. It can be an estimate. It can be an estimate.

Mr. Baker. Yeah. I think the $3 billion funding number is a good number, and, you know, that will allow companies like Mavenir or Altiostar to scale and greater support the markets.

The Chairman. All right. Thanks so much.

And I am giving back 22 seconds, Chairman Doyle.

Mr. Doyle. I want to thank the full committee chair for his good example.

I understand Mr. Latta is en route to his office to get on a different computer. So, with that, I am going to recognize Mr. Guthrie for 5 minutes.

Mr. Guthrie. All right. Thank you, Mr. Chair. Thanks so much for having this hearing.

As you know, I was one of the sponsors of the Open RAN moving forward, but I just want to make sure we look at everything as we move forward.

But, first, Mr. Donovan, one of our priorities last Christmas was the rip and replace so we could secure our networks from companies like Huawei and ZTE. And you talked a little bit about barriers. Would you talk a little more about potential barriers that remain, particularly in permitting, barriers to move forward with the new equipment?

Mr. Donovan. Sure. Thank you, sir, and thank you for the leadership in both getting the program passed and funded.

Some of the barriers that do remain for those carriers is, one, knowing kind of

what exactly the application process is going to look like, knowing when and how they will be reimbursed and so they can, in turn, pay the vendors that they are working with on the process. Some of those things are additional clarity from the FCC would be really helpful so that, while carriers are having these conversations, they can lock in some of these agreements and get moving on the work.

On the permitting side, this comes back to the idea that, for all the talk of calling it rip and replace, it is really replace and then rip. We can't afford to take away connectivity in the rural areas where these carriers are often the only provider. And so, to stand up to that second network alongside, oftentimes there will be additional permitting work for colocation, review of tower integrity to make sure you can put up that additional equipment.

And, even in some places, if you have microwave backhaul today, you know, if it doesn't make sense to continue with microwave backhaul, setting up a separate link, either because of spectrum or technology, then clearing the permitting to provide fiber to that site, which is going to enhance services for everybody that uses that site long-term. So getting through --

Mr. Guthrie. Yeah. I just want to get to some more questions.

So, Mr. Donovan -- so you kind of struck my thoughts as you were talking earlier. Background's in manufacturing, putting in complex manufacturing systems. And the best scenarios that we always tried to look for was turnkey, where a vendor came in and all the subsuppliers were part of that vendor, and they hand you the key, and it worked, because, if it didn't work, you knew who to talk to.

And so you were talking about, you know, trying to come up with arrangements. I know that is difficult to do sometimes. But -- so I just want to kind of get your thoughts on what -- how do you make sure, if you have different vendors, the components are

going to work together, or the components and the system work together?

And then I know you talked about who is responsible if it doesn't, and so kind of further elaborate on that as well?

Mr. Donovan. Certainly. So that is why some of the different testing is important, you know, before you put the technology out in the field, especially for carriers that have existing network footprint. And that is why some of the educational initiatives that go alongside it play a long role in building that trust -- you know, things like today's hearing so everyone can learn more about the technology; the FCC has a proceeding to learn more about it -- that can increase trust in this so that, as we move forward, that carriers feel confident to deploy it.

There has also been some, you know, exciting discussions in the industry between the different providers of this technology, and architects are working in unique partnerships so that they can provide that turnkey solution to carriers.

Mr. Guthrie. Okay. Thank you so much.

And then, Mr. Amin, your company, Rakuten, has used this process. And so your concerns about who is responsible if you have multiple vendors?

And the other thing would be just security. If you are buying from one vendor, you have one security concern about that one vendor that you are working with. But, if you have multiple vendors or multiple components, that adds to that equation. Could you just kind of talk about how you address the comment -- the issue that Mr. Donovan brought up, and then the security issue?

Mr. Amin. Absolutely.

I think, when we looked at the security architecture for Rakuten Mobile, it was really built under the premise of zero trust. And, when we looked at the -- today's network, we still have many proprietary interfaces, and I call these are the black boxes

that exist into our architecture.

We needed to evolve from a company that just always looks and trusts everything that any OEM brings to a company that is able to validate not only the software component, but also the hardware and the silicone, and not only the hardware and the silicone, but it is also its origin, where it is manufactured, where it is built.

So now our case. It was by design and by choice that I personally have looked at the components that are involved, and the most complex things in mobile network today, which is the remote radio heads and the radio units. I honestly will tell you I did not find it complex. I did not find it complex to really get to this level of detail.

I find technology is hardware for us. It is okay for us as an operator to serve the duties that we have for our government as well as our consumers to protect the apparatus of our security architecture, that we needed to really understand the entire supply chain management.

And I would tell this committee it is critical to do so. It is really, really critical to understand that we need to evolve from the past into a new business model that an operator and, even to a certain extent, the new vendors must learn and understand how to build and secure modern platform, especially in Open RAN.

Mr. Doyle. The gentleman's time has expired.

Mr. Guthrie. My time is expired. I yield back.

Mr. Doyle. Chair now recognizes the gentleman from California, Mr. McNerney, for 5 minutes.

Mr. McNerney. Well, I thank the chairman for having this hearing. I want to thank the witnesses for informative testimony and answers to the questions.

My first question -- and also want to say it is interesting having a hearing where the witnesses are, by and large, reinforcing each other's positions.

Mr. Baker, my congressional district includes both rural and urban areas, and a large portion of the households are low income. Would you discuss the likely impact of Open RAN for consumers in rural areas and for low-income consumers in both rural and urban areas?

Mr. Baker. Yeah. Thank you, Congressman McNerney. And, personally, I would like to say I had the pleasure of building the technical wireless network in California and Nevada, so I really understand the area well.

To the extent that -- you know, it all comes down to operating a budget. With Open RAN, the promise of lower costs -- in fact, it has been proven lower costs will allow operators to spend more and build more regions out in the network. It all comes down to the budget they have available and then the cost of the equipment. And, you know, with lower margin equipment, essentially the operators can do far more.

Mr. McNerney. Well, thank you.

Mr. Baker, I am also worried about the growing number of cyber threats. I have heard that Open RAN offers security benefits but that has potential to increase the threat surface from potential attacks.

How can Open RAN help improve the security of our networks and also be a greater -- have a greater threat surface that we can -- should we be concerned about that with Open RAN?

Mr. Baker. Sure. Good question.

The Open RAN is tested, and it is secure, and it allows -- through interoperable interfaces, allows people to be constantly monitoring, checking, and testing those elements. And so, if there is a question about a certain element in the network of the security value, then, you know, it could be either replaced, it could be monitored, it could be fixed. But, you know, it adds another level of security.

And I think, you know, I referenced Stephen Bye from DISH. He says, you know, when you turn the lights on with open interfaces, you can see the cockroaches that are in the network.

Mr. McNerney. Thanks for that visual there.

Mr. Mezzalingua, I serve as the co-chair of the Artificial Intelligence Caucus, and I understand that parts of Open RAN utilize the AI and machine learning.

What are the opportunities that AI offers for Open RAN, and what are the challenges?

Mr. Mezzalingua. Well, I think that AI -- thank you, Congressman, for the question.

I think that there are so many applications that were mentioned earlier -- AI is one of them, IoT, where there is a lot of discussion and talk around this. There is the use cases at the moment are not crystal clear. I think a lot of them are coming into view.

What I do know is that, for us to take full advantage of what 5G brings in this eco -- the broader ecosystem, we are going to need to have capability in this country to be able to address it.

You referenced cybersecurity previously. You referenced the need for innovation, manufacturing. All of this is ultimately incumbent upon having a U.S. industry so that we cannot be dependent on any foreign actors to come up with whatever applications -- AI, security -- that are called upon in this new era of communications.

Mr. McNerney. Thank you.

Ms. Rinaldo, another area I am interested in is the intersection of AI and spectrum management. Looking more broadly beyond Open RAN, what are some of the benefits that AI could offer for spectrum management, and should we be taking a closer look at that?

Ms. Rinaldo. Thank you, Congressman.

Yes, absolutely. I would say one of the most fascinating parts of Open RAN, it allows for a more layered approach going forward. So long gone are the days where we are stuck to a 10-year life cycle where, as advancements come online, we can inject them into the network.

We have one member company of our coalition, DeepSig. They are probably the smallest. They are 25 people in a reworks building in north Arlington, but they are doing fascinating work around AI, machine learning, and how do we become more efficient with what we have in the spectrum space?

So, again, that layered-on approach is really going to benefit not only updates to the network, but, as your committee well knows, how can we be more efficient with the spectrum that we have?

Mr. McNerney. Thank you. I am going to try and sneak in another question, Mr. Chairman.

I want to make sure that the U.S. remains competitive in wireless technology, including 5G and the generations that follow. Mr. Donovan, as you point out in your testimony, in recent years, we have seen a lack of Federal agency coordination on spectrum policy.

How does the lack of Federal agency coordination on spectrum policy impact U.S. competitiveness in wireless technology and the deployment of wireless technology?

Mr. Doyle. And I would ask that the --

Mr. McNerney. -- if you can help me out.

Mr. Doyle. And please try to answer that quickly.

Mr. McNerney. Thank you.

Mr. Donovan. Certainly. You know, spectrum is the lifeblood of wireless.

And, if you don't have certainty that the spectrum that you are designed with is going to be able to be used to the maximum extent that it was brought to market, then that is going to undercut wireless of every generation.

Mr. McNerney. Thank you. I yield back, Mr. Chairman. Thank you.

Mr. Doyle. Okay. Gentleman's time is expired.

I understand our ranking member is back with us. Bob, you are recognized for 5 minutes. Hopefully --

Mr. Latta. Thank you, Mr. Chairman. And I appreciate your forbearance. It appears my microphone on my computer has crashed, so sorry about that.

Mr. Donovan, I can start my first questions with you. And, if I ask a question that might have already been asked while I was trying to get to another computer, just tell me that, and we will move on to another question.

But, as we know that, under the Secure and Trusted Communications Act, which helps our small and rural telecommunication providers replace potentially compromised equipment from bad actors like Chinese companies Huawei and ZTE, now that we have secured the 1.9 billion in funding to implement this law, we need to make sure that companies can remove or replace covered equipment without delay.

Under the act, those reimbursed by the program are required to complete the replacement of covered equipment within a year of receiving that funding. However, as today, the FCC is still in the process setting up the reimbursement program.

What are the barriers, Mr. Donovan, that you see that might delay the removal of this equipment from our companies out there?

Mr. Donovan. Well, thank you for the question.

Quickly rehash some previous discussion that there are some permitting issues as you really need to replace the existing network before you can remove the previous one.

Some of the other barriers, you know, where we see it now is lack of confidence in the final application process of knowing exactly what a carrier will have to do to qualify. You know, these are carriers that are not in a position to get it wrong. They have to get it right. The networks are in areas that are often uneconomical to serve without support already. So they do need to make sure that they are taking the steps to follow the rules directly.

And other issues out there, we -- we also need a workforce that can complete this at the same time as there is other commands in the workforce, including nationwide upgrades to 5G, expanded network deployments. And even factors like weather are becoming an issue where you need to plan your build season out months in advance, especially in some areas with more harsh terrain, where you don't have a build season that goes around to the year.

You have tower techs that aren't really thrilled about climbing up a tower at minus 40 degrees, especially if there is enough workforce demand that they can go elsewhere. So you are competing for that workforce as well as -- internationally, across the country -- as well as trying to get your work done.

Mr. Latta. Well, thank you. And let me ask a follow-up on this. As your companies continue to deploy the wireless infrastructure, how can we encourage them to invest in the innovative solutions like Open RAN-compatible technologies, because I know you said there is -- all the issues that you are dealing with, but how do we get them out there to do that?

Mr. Donovan. You know, additional information, test beds, access to the knowledge base that you need to move this forward. CCA members, you know, especially those that are subject to the rip and replace proceeding, have been evaluating Open RAN network. A recent survey showed that, of all our members, showed that

89 percent are evaluating it right now. To the extent that some of the outstanding questions that we are discussing at the hearing today and that are taking place in the record at the FCC can be resolved, that is going to increase confidence in carriers of all sizes and lead to greater adoption to the technology.

Mr. Baker. Congressman --

Mr. Latta. Let me ask you a better question here that -- are there any deregulatory measures, such as streamlining upgrades to existing infrastructures, that can help speed rollout of Open RAN-compatible technologies?

Mr. Donovan. Yeah. I think, with -- especially with Open RAN, as we are looking at different types of network architecture, we want to make sure that the permitting processes apply for what is actually being put up. And, in some cases, this may not be on the huge macro towers. It could be we want to just right size the permitting process so that there is confidence both from the permitting agencies that are going through the review process, as well as carriers, that they will have certainty in terms of cost and time to get approved to go to construction.

Mr. Latta. Let me ask one final question.

You know, as we look across everything that is going across the world, especially where the Chinese technology is today, are we on par right now? Are we leading? Are we falling behind? Are we -- where are we at, would you say, right now, out there, with the other technologies?

Mr. Donovan. So we are competing in the international marketplace, and there is potential both of the -- you know, several of the companies that are -- my colleagues on the panel today, as well as the existing trusted providers that, you know, even if headquartered in other places, do have United States manufacturing and jobs.

So there is -- it is -- the competition is hot to -- an important topic that you touch

on, and it is going to be really important for the United States to continue to push forward.

Mr. Latta. Well, I hear -- the word I heard from everybody today was the word competition and moving forward, and that is what we want to make sure we are doing.

So, Mr. Chairman, I yield back the balance of my time. Thank you.

Mr. Doyle. I thank my friend.

Let's see. Mr. O'Halleran, I believe you are next. You have 5 minutes.

Mr. O'Halleran. Thank you, Mr. Chairman. I appreciate that. I want to thank the panel for being here today on these important issues. I appreciate your coming and continuing efforts on securing America's network technology. This remains an important national security priority.

Last Congress, I was proud to support Chairman Pallone's USA Telecommunications Act, which was a good first step in securing our network equipment. While our networks must be protected against hackers and state actors, we also need to finish the job on closing the digital divide.

In rural Arizona, only 66 percent of the population has access to broadband at the FCC's minimum speed standard. Consistently, constituents across Arizona note that access to reliable high-speed broadband is a top priority for them.

Inequities in broadband access results in poorer health and educational outcomes for those of us who live in rural and Tribal communities. This extends beyond using the internet at home. Like many rural areas, my district has miles and miles of dead zones where our cell phones read, No service. It is the size of a little bit larger than Illinois.

This is a problem when my constituents need to contact medical help or emergency services in remote area. The COVID-19 pandemic has only highlighted, as many of us know, the need to expand access to rural communities so that students,

doctors, and rural economies can compete in the urban areas of our great country.

Mr. Donovan, I appreciate the focus in your testimony on the need to advance mobile connections. Do the things we are talking about today -- network security and open standards -- impact the speed wireless carriers can build service in rural areas?

Mr. Donovan. Thank you, sir, for the question and for the focus on rural. And I want to underscore your point of the importance of the need for mobile connectivity, not only at the home, but while you are moving about in ways that can only be met by mobile technology.

In terms of the speed to deployment, the potential for additional vendors and lower costs can certainly help, as you know well that, in some places, the cost factor makes it very challenging to deploy services in rural and Tribal areas. So that could certainly help in terms of expediting deployment.

Mr. O'Halleran. Thank you very much.

Mr. Mezzalingua, I know that JAM is doing good work in Tucson, bringing internet access to thousands of residents through the city's community wireless program.

How is that going, and how can this public-private partnership succeed and be replicated in other communities?

Mr. Mezzalingua. Thank you, Congressman.

First, I would say that the government has a very significant role to play. You mentioned the public-private partnership, but the government has a major role in the sense that, almost 2 years ago now, when the CBRS spectrum was released, which was licensed spectrum, that meant that the power and sophistication that was normally reserved for the wireless carriers is now in the hands of enterprises or municipalities and consumers, and then, of course, the DOD and Pentagon.

So that was a major move to begin with. And then, of course, the CARES Act

funding enabled them the rollout in Tucson in particular.

Our view is that the example of Tucson, which is a highly sophisticated network deployed at, you know, rapid time, very quickly, is something that is meaningful to everybody right now that has a need for the urgency of having broadband. But the -- also, a critical issue is these refresh cycles -- these hardware refresh cycles that just are a constant drain on IT budgets everywhere -- public, private.

This is something that, with software, you begin to transcend that, because, instead of this rip and replace or replace and rip, whatever you call it, you install it once, and then you software upgrade like we are used to every day with our phones. So this is where the technology is today. This is how you stretch taxpayer dollars so that you actually ensure this -- you build it once, and then you -- you build upon it.

This is all the benefit of what we are looking at right now with the Telecom Act, with O-RAN. It is all overlapping and consistent.

Mr. O'Halleran. Thank you. Mr. Chairman, I yield.

Mr. Doyle. Thank you.

Let's see. I don't see Mr. Kinzinger, so I think I am going to recognize my fellow Pittsburgh Pirate fan, Mr. Bilirakis, for 5 minutes.

Mr. Bilirakis. Thank you, Mr. Chairman. We have two games today.

Mr. Doyle. I know.

Mr. Bilirakis. Two games.

Mr. Doyle. We are on a streak, Gus. We are on a streak.

Mr. Bilirakis. Double header. That is right.

So, Mr. Donovan -- I thank everyone for their testimony. In the written testimony, you discussed the significant loopholes and failures in the spectrum management process. I am glad to see your support for my bill, the Spectrum

Coordination Act, as part of the solution.

As you know, this bill would require the FCC and NTIA to update their 18-year-old memorandum of understanding on spectrum coordination. I think it is about time.

Can you specifically discuss the problems that are occurring because of outdated interagency agreements, like the existing MOU, which leads to the need for a reboot, please? Thank you.

Mr. Donovan. Sure. Thank you for your question, sir.

And so the MOU between the NTIA and the FCC is informed, as you mentioned, by the IRAC, the Interdepartment Radio Advisory Committee, process. That is the place that is designed to assist the assistant secretary at NTIA and assigning U.S. frequencies for government use and reviewing how they are used.

As that process informs spectrum, that gets reallocated and then eventually brought to the market by the FCC. That process is the appropriate way to raise concerns. What is troubling right now is, when the process is complete, they have gone through sufficient time, NTIA and FCC reach agreements based on the science and the engineering behind these spectrum policies, and then separate departments raise concerns after the fact.

We have seen it in too many bands so far, and especially when, recently, some concerns have been raised after auctions have been completed that risks undermining faith in spectrum auctions and in business plans to know that, once you get the approval from regulators, you will be able to use spectrum along the rules that it was brought to the market under.

Mr. Bilirakis. Thank you.

Next question is for Ms. Rinaldo.

In your experience as administrator of NTIA, are there specific things you would

want to see addressed if and when these agencies formalize a new agreement? How can we encourage agencies to follow the statutory process and work through NTIA when they have a spectrum issue with the FCC, please?

Ms. Rinaldo. Thank you, Congressman.

Mr. Bilirakis. Thank you.

Ms. Rinaldo. Yes, I do agree, and I concur with Tim's comments. I think that NTIA and FCC must formalize a process, memorialize it in writing that, when an agency does go outside the normal process, how the FCC will respond. However they choose to be the right process, it needs to be in writing, and it needs to be consistent. And I think consistency will go a long way in ensuring that agencies follow the proper due course.

Mr. Bilirakis. Very good.

Mr. Chairman, after the introduction of the Spectrum Coordination Act last year, I was pleased to see that FCC and NTIA take interest in revisiting the agreement. However, we should not assume they will finish this process. We should move forward with ensuring this process comes to the completion with the Spectrum Coordination Act.

There has been strong bipartisan interest for this idea since 2000 -- since 2020 -- the 2020 letter by Chairman Pallone and then Ranking Member Walden. So this legislation will also help reinstate NTIA as the authority on spectrum matters as it incorporates lessons learned over the last 18 years, which committee leaders recently addressed in a letter earlier this week.

So I ask the committee -- the committee leaders on both sides of the aisle to give strong consideration, if you will, to moving the Spectrum Coordination Act forward as a sign of unified committee commitment to this cause. I think it will go a long way.

And I yield back, Mr. Chairman. Thank you.

Mr. Doyle. Okay, Gus. Thank you for your comments.

Let's see. Miss Rice, you are recognized for 5 minutes.

Miss Rice. Thank you so much, Mr. Chairman.

Mr. Baker, in your written testimony, you talk about how, around the world, allied nations are advancing aggressive policies to build their next-generation mobile networks with Open RAN, and you mention that -- you talk about the MOU that the five major European operators signed, totally committing to deploying Open RAN across the European Continent, but you say that, quote, "this full embrace of Open RAN has not yet happened here in the U.S."

Can you just expound on that? And what is holding us back from just that full embrace?

Mr. Baker. Yeah. Thank you, Congresswoman. This is a great question.

I think the ability to get open standards that are interoperable is the clear message that needs to be taken that operators then can bring other vendors into their networks. At the moment, the current vendors which supply the United States networks have got them locked down to the extent that it is difficult for operators to bring new vendors into those networks.

And, in Europe, you know, even as of yesterday, you know, 25 percent of the market was being set aside for -- or being discussed to be set aside for new, small operators.

And I think that is the challenge that the U.S. has, is how to encourage the operators to actually embrace Open RAN and follow -- you know, follow open standards in the future so that we don't end up with a situation that, you know, if I am going to change a light bulb, I am going to have to change the wiring as well before I can put a new light bulb in.

Miss Rice. Uh-huh. Well, you also talk about the -- you know, the need to

provide financial incentives as well. And, Mr. Baker, I heard you -- you were asked about the amount of Federal investment that has to be done, and I think you were the one that said it should be around $3 billion.

Are there any witnesses who have any -- who take issue with that investment amount so we can know as appropriators exactly what needs to be invested?

So I assume that everyone is -- embraces that -- the amount that Mr. Baker talked about?

Ms. Rinaldo. Congresswoman?

Miss Rice. Yeah.

Ms. Rinaldo. On behalf of the Open RAN Policy Coalition, I would say that we support the full funding of $3 billion.

Miss Rice. Great. Thank you.

Ms. Rinaldo. Thank you.

Mr. Mezzalingua. Congresswoman?

Miss Rice. Yeah.

Mr. Mezzalingua. What we can say is that we have one company -- that is Huawei -- that, over the years, has been, according to reports, spent tens of billions of dollars on their R&D. So we certainly think -- and we think that, with our approach and the things that we have all discussed today, we are -- that is not something that we are -- we think is necessary to compete.

However, the number of 3 billion certainly is an important start, as somebody had said previously, for U.S. competition and restoring leadership just so that the playing fields become leveled.

Miss Rice. Yeah, for sure.

Mr. Mezzalingua, if I can stay with you. You know, I am very happy to hear about

your company continuing their investment, certainly in New York State, my home State. Can you just talk about the -- can you just talk a little bit more -- I have got about a minute and a half. I would just like to hear more about the campus -- the 5G campus that you are building in Syracuse.

I think it is so important for you to be successful in that, and, you know, for all of the reasons, it keeps us, you know, competitive. It is a job creator. But we need more of this. If we are going to keep manufacturing here and dealing with supply chain issues, we need to support companies like you and what you are doing.

If you could just talk a little bit more about how you got that off the ground and what you see as its potential successes.

Mr. Mezzalingua. Sure. Sure.

We made this decision long ago really to enter into the space and then of course build the facility, long before this discussion was elevated to this public level. And, when we think about where the industry is going, we arrived independently at what the operators arrived on their own about O-RAN, which is competition makes sense, it makes sense to specialize, it makes sense to virtualize and use software. And that is where the investment came from.

But, as far as what can be done going forward and how to encourage more of this kind of work, we are building this factory. We are excited about it. It is spanning a city block. We are going to have a network operations center. We are going to have manufacturing.

But what is needed is that we don't want to become hostage to various supply chain issues in other countries, so we need more investment. And we have outlined this in our support in -- of all the subcomponents that are needed to then put in those products to the extent they are not software. Where you can make it software,

you -- we do, but ultimately software must run on hardware.

So I see where my time is up, but there is a lot to be done that is within some of the proposals in the funding act that can start to bolster a U.S. industry.

Mr. Doyle. Gentlelady's time is expired.

Let's see now. Mr. Johnson. Bill, you are recognized for 5 minutes.

Mr. Johnson. Well, thank you much, Chairman Doyle and Ranking Member Latta, for holding this important bipartisan hearing.

I really appreciate today's discussion, particularly on how concepts such as Open RAN can help make our networks more secure and interoperable. You know, as co-chair of the Congressional 5G Caucus, I completely agree that the U.S. must remain a leader in wireless technologies, and that is for expanding and upgrading connectivity, furthering American ingenuity and economic competitiveness, and of course for strengthening our own national security.

So, Ms. Rinaldo, we all agree that the deployment of Open RAN technology is promising in terms of 5G innovation and security, but the public policy implications aren't always clear. In your view, should the Federal Government issue mandates to deploy Open RAN or condition subsidies on deploying Open RAN in a provider's network?

Ms. Rinaldo. Thank you for the question, Congressman.

As a coalition, we decided from day one that we were not going to support mandates, that we were going to be technology agnostic, and we were going to advocate policies that help advance Open RAN, and that is what we will continue to do.

We believe that Open RAN is the future, and we believe that working with the U.S. Government as well as our partners around the world could help bring it to scale.

Mr. Johnson. Okay. Mr. Donovan, would you like to add anything to that question?

Mr. Donovan. I would agree with Ms. Rinaldo that we do not support mandates. You know, if the technology lives up to its promise, then it will win in the market, and it will be deployed based on industry demand and tameframes. I mean, and, look, at every G, there have been choices that operators have to make in terms of technology architecture and other things, and we have not mandated those technologies, and that has led to American leadership.

At the beginning of 4G, for one example, there was some competition between technology for WiMAX and LTE, and some operators chose one, and others chose LTE. And that freedom of choice in the marketplace led to the United States leading the way in wireless in fourth generation with 4G LTE.

If the government had stepped in and mandated another choice, that could have ceded that ground to someone else internationally. So that lack of a mandate really advanced United States to the front of the line.

Mr. Johnson. Okay. You know, I have been doing information technology professionally since 1978, before it was even called information technology, and I can remember the positive impacts that open systems architecture had on an explosive innovation in information technology.

But, Mr. Donovan, continuing with you, how can we incentivize carriers to invest in upgraded technologies with open interfaces?

Mr. Donovan. So it is education. It is moving forward. You know, there is interest across the board. There is no one in the industry that is opposed to advancing O-RAN. You know, all of the carriers, all of the major providers are taking part in this process, you know, to some degree. And so those collaborate efforts will continue to move things forward.

In terms of upgrades, it is continuing to push for the latest technologies. You

know, completing the IP transition for some carriers that haven't been able to do so yet will give opportunities to continue to upgrade technologies, including using open interfaces.

Mr. Johnson. Okay. Mr. Amin, we have heard a lot about how Open RAN-compatible networks could bring more secure options to the marketplace, but what benefits does virtualizing a network for -- have when it comes to security?

Mr. Amin. Thank you very much, Congressman.

I think, today, we spent a lot of the time obviously talking about Open RAN, but there is some what I believe a very good underlying story to what is happening in the U.S. and its leadership in key technology areas.

In 2018, when we looked at building Rakuten Mobile, our aspiration was to look and understand what happened in the public cloud companies in the U.S. With significant advancement on virtualization, and from virtualization to consumerization, and new technologies such as serverless architecture.

This showed clearly that U.S. has the foundation to build and advance future technologies such as Open RAN, open Core network platforms, Transport, and other support systems. This holistic approach allows you as an operator to have complete visibility; complete control points; and, most importantly, complete isolation in network components. So, if one network component is contaminated, they don't impact other network aspects of your deployment.

Mr. Johnson. Very quickly -- and I have almost run out of time -- what impact will virtualized networks have on the ability to add capacity quickly?

Mr. Amin. It is -- I mean, the word that I would tell you that nobody in my view in telecom talk about is elasticity. Nobody discusses this. But luckily, today, with our platform and Rakuten Mobile and the platforms that we have created and RCP, we have

enabled autoelasticity, which doesn't exist in the industry today. So capacity management for us is a thing of the past.

Mr. Doyle. Okay. Gentleman's time has expired.

Chair now recognizes my good friend from California, Anna Eshoo, for 5 minutes.

Ms. Eshoo. Thank you, Mr. Chairman, for this very important hearing and to all of the witnesses. You have all given terrific testimony.

I want to go to Mr. Mezzalingua first.

As you may know, I have been focused on the national security implications of telecommunications for years. I first wrote to the FCC about the threat of Huawei and ZTE back in 2010, and our committee has done important work in the last Congress to protect national security, including the creation of a program to rip and replace equipment manufactured by suspicious vendors.

Let me just put this succinctly. I don't want to have anything to do with Huawei or ZTE. We have the capacity in our country with American companies to do what needs to be done and deliver it to the American people safely.

Can you tell us why hardware replacement isn't sufficient and why we need an open software-based solution to the national security threat and our wireless infrastructure? And succinctly, because I have --

Mr. Mezzalingua. Yes.

Ms. Eshoo. -- only 5 minutes.

Mr. Mezzalingua. Yes. Thank you, Congresswoman Eshoo.

I mean, fundamentally and succinctly, the -- it all comes down to, if you have software and if you have control of the software and it is U.S. based, you now have more control over this because it is boundariless. With hardware and with, in particular, existing entities that -- here, you have legacy supply chains that are open to compromise

or disruption.

Ms. Eshoo. Right. Thank you very much. I think that every member has digested that really well.

To Mr. Donovan, we have obviously heard a lot about 5G. It is constantly being advertised, but most people don't know that most of our calls, our texts, and data flow through 4G, 3G, and 2G. And this worries me, because older protocols are inherently less secure, and we don't have a clear, comprehensive understanding of all the vulnerabilities.

This is why Congressman Kinzinger and myself introduced the Understanding Cybersecurity of Mobile Networks Act, which requires the NTIA to study vulnerabilities in legacy networks.

How reliant are your member companies on legacy networks, and how long do you think we will continue to rely on these older networks?

Mr. Donovan. Thank you.

And, first off, this bill is a great idea. You know, this is a way to get at some of the security threats before they become front-page news that they have been exploited by a bad actor, so that is critically important.

Small carriers do -- are going to continue to rely on 2G, 3G, and 4G networks for the foreseeable future. In some recent surveying of our members of that -- you know, 65 percent of members are looking at a 3- to 5-year window for continuing to rely before phasing out their 2G and 3G networks with, you know, over 85 percent of our members surveyed that they don't plan on fully phasing out their 2G, 3G in the next three years or longer. So identifying those bugs now is really important.

Ms. Eshoo. Okay. And another question to you, Mr. Donovan. I think that there is bipartisan agreement that the Federal agencies that use spectrum have been

uncoordinated, and that is putting it charitably. But I think the discussion gets caught up in too many agency acronyms, spectrum bands, auction designs, and other important but really wonky topics.

Can you distill for -- distill this down for us? How does the lack of coordination in the Federal Government impact underserved communities?

Mr. Donovan. Well, most simply way I can put it, it means that spectrum is not available to build out services to bring connectivity to those underserved communities. A lack of coordination means that we aren't going to uncover where different Federal agencies could collaborate on spectrum, could share spectrum, and free up additional spectrum to be used by the industry.

Ms. Eshoo. Are you referring to the public side of this and the responsibilities that we need to carry out? I mean, there are plenty of companies, but they don't go into these areas. So can you clarify that?

Mr. Donovan. Sure. So, you know, having access to spectrum is an important part of it, and --

Ms. Eshoo. We know that. We all know that, but companies have brought spectrum, and they use it where they are going to use it. But we are still faced with underserved and no service in some places in our country.

Mr. Donovan. Yeah, that is -- that is the problem. We need to make sure that investment in infrastructure includes getting those people connected and -- but, very briefly, on the coordination piece, where that affects is that, if carriers don't know where they can and can't use spectrum when they are working on a business plan and making long-term investments, you can undercut the ability to bring service everywhere --

Ms. Eshoo. Does that go to the maps? Does that go to maps?

Mr. Doyle. The gentlelady's time has expired.

Ms. Eshoo. Can he say yes or no? Does that go to the maps?

Mr. Doyle. Sure.

Mr. Donovan. Yes.

Ms. Eshoo. Okay. Thank you very much. Yield back.

Mr. Doyle. Okay. Let's see. Next, we have Billy Long. You are recognized for 5 minutes.

Mr. Long. Thank you, Mr. Chairman.

And, Mr. Donovan, what can Congress do to help smaller, rural carriers deploy more secure networks, whether it is Open RAN architecture, or something else?

Mr. Donovan. Yeah, making sure that carriers have that -- that information is critical to it. You know, carriers that deploy now covered equipment did so because they were forced to choose lowest-cost options, and there was not that information shared by the government that they should not do so.

They don't -- often don't have the same, you know, teams of security experts that some of the largest nationwide providers do. So making sure there is that flow of information is essential as these carriers make their choices.

And something that we found that was really successful in that, in 2019, we partnered with the Chamber of Commerce on several rural education initiatives that brought together actors from across the Federal Government, from the whole alphabet soup of different agencies for in-person, you know, off-the-record discussions that really facilitated a flow of information both ways, from the carriers to the government and vice versa, that has led to making some better security decisions.

Mr. Long. Okay. Thank you.

And, Mr. Amin, for you, can you explain the difference between a virtualized brand and an Open RAN, and how do these type of architectures interact?

Mr. Amin. So, in the platform choices that we started with, we wanted the software to completely be desegregated from hardware. In the industry of Open RAN, this disaggregation comes into the form of taking a separation of what is controlled -- a product or a virtual machine's both CEU and DU, and those components are completely software based riding on commodity of hardware.

And, in cloud RAN and what existed, by the way, for decades as traditional vendors promoted cloud RAN, you still have quite a bit of dependencies on proprietary hardware to run the software. And, in the virtualized architecture and the Open RAN platform architecture, the industry as a whole is moving into a software -- a software architecture for our really complex and important function in the radio.

And, as you know, this is critical, because this is what we spend, as operators, 70 percent of our packets is spent into the radio domain.

Mr. Long. Okay. Thank you. And I will stick with you for a minute, Mr. Amin.

How does Open RAN architecture promote a more competitive marketplace, and can you please describe how this type of architecture leads to more secure communications?

Mr. Amin. So, in the definition of the security architecture and the apparatus, I think we discussed a bit earlier today that I think it is really, relate important to apply a zero-trust policy on every network component you bring to your operation.

I mentioned earlier that I believe that we need to take a far more advanced look at not only modern architecture as well as legacy architecture. That involves looking at open interfaces. We need to eliminate the proprietary interfaces that exist today that would allow the operator to insert additional control point, bring better visibility.

And, most importantly, we talk a lot, of course, about software, but I don't think yet we have discussed enough about securing the supply chain and understanding where

this hardware gets made, where does the supply chain of the silicone and the components come from?

And that is what I think about the open network advantages to security. I really think it is critical -- critical to look at this as a totality, including the supply chain of components, hardware, as well as software.

RPTR BRYANT

EDTR HUMKE

[1:24 p.m.]

Mr. Long. Okay, thank you.

And, Ms. Rinaldo, same question for you. How does Open-RAN architecture promote a more competitive marketplace, and can you please explain how this type of architecture leads to a more secure communications network.

Ms. Rinaldo. Thank you, sir. Yes. From what I hear from my members, that prices can be as much as 30 percent lower. Now, if you go by a cell tower and look up, there is the radio access network. Multiply that by all the cell towers, and we are discussing the most expensive part of a telecommunications network. If you can get prices at 30 percent lower, you are now building a case to build out in more rural areas.

And as far as the security, Open-RAN is building on the secure networks of 5G. Additional competition is going to drive security enhancements. In 2021, consumers are demanding security and operators are requiring it. And the additional competition is going to allow for increased security benefits in this space.

Mr. Long. Okay, thank you.

Mr. Chairman, I yield back.

Mr. Doyle. I thank the gentleman.

The chair recognizes the gentlelady from California, Ms. Matsui, for 5 minutes.

Ms. Matsui. Thank you very much, Mr. Chairman. And this has truly been a very interesting and productive hearing.

We have all talked about spectrum coordination, which I really believe is very, very important. In fact, I wrote to President-elect Biden 4 months ago, urging him to adopt a unified approach to spectrum policy and a clear process for resolving interagency

disputes, because the uncertainty is just untenable.

It is critical, obviously, NTIA resumes its role as manager of the Federal Government's use of spectrum. That will allow NTIA to effectively represent Federal interests before the FCC and assure that FCC is not forced to interpret divergent messages from individual Federal agencies.

Let me give you an example here. In October, the FCC is planning to conduct an auction of the 3.45 gigahertz band. While there is significant interest in the spectrum, ongoing uncertainty about the DOD's plans for this spectrum could affect the auction's success.

While I do know firsthand that the Department's use of spectrum can be complex, which I did see working with DOD on the AWS3 auction, it is still imperative for all involved to have accurate and timely information.

Mr. Donovan, can you tell me how increased information sharing from DOD will create a more stable and successful U.S. session regime, and what are the implications of the 3.45 auction?

Mr. Donovan. So this is a really important time for that spectrum band, in terms of bringing it to auction. It has been a little bit of a moving goalpost, where initial reports from NTIA looked like 93 percent of the population would be unencumbered with that spectrum. That has been updated that now the DOD may remain on up to 20 percent, including some really key markets in much of the East Coast from New York City to South Carolina, markets on the West Coast.

And we have a high relocation cost for this band. It has been pegged around $13 billion. So it has implications on what happens to the success of an auction if you take some of those major markets out of play entirely or you don't provide carriers with the information about what that coordination process is going to look like. So --

Ms. Matsui. Well, thank you. And I think what you are doing is saying exactly what I am saying, that we do need more coordination amongst the agencies in order to quickly make a decision on some of these aspects of it.

Let me go on to Open-RAN and consumer prices. With open and interoperable technology, network operators can use software to take the place of physical technology like switches or routers. This increased flexibility of virtualized cloud-native platforms can drastically reduce the cost of building and maintaining networks.

Mr. Amin, how has this new technology helped reduce costs for Rakuten, and are those savings being passed along to the consumer?

Mr. Amin. Thank you very much, Congresswoman. Indeed, this is a very important point. First of all, our technology choices were deliberative with one idea in mind, that we needed to disrupt the current marketplace in Japan, allow consumers to access our services at a much more affordable price.

And for us to enable that, we knew that cloud and the economics that it brings will be substantial. And we realized more than 30 percent total cost of ownership reduction in running, maintaining, and deploying this network.

And, indeed, today, if you see what has happened in Japan, where it was a country in which data consumption was one of the most expensive in the world to today being one of the lowest in the world, thanks to such advancements in technology such as Open-RAN, open network, and cloud-native architecture to run and manage today and tomorrow's network. So, indeed, the consumers have benefited tremendously from Open-RAN platforms in Japan.

Ms. Matsui. Okay, thank you. You know, I joined with Congressman Michael McCaul, who introduced the CHIPS Act, which would help address the semiconductor shortage by addressing American manufacturing capacity. I included the CHIPS Act as

an amendment to last year's NDAA and recently met with President Biden about the urgent need to fund the programs authorized by this bill. I was pleased to see the President's American Jobs Plan includes $50 billion to implement the CHIPS Act.

Mr. Donovan, can you describe the threat posed by prolonged semiconductor shortage for America's wireless innovation future?

Mr. Donovan. We have a huge demand for wireless equipment right now. We have talked about the rip and replace program. We have talked about the global competition to get to fifth-generation services. And anything that delays access to equipment or increases costs puts us at a disadvantage in all of those pursuits.

Ms. Matsui. Right, absolutely. And this is part of the supply chain that is really critical, and this could be also American manufacturing.

So I can't yield back 8 seconds here, so I yield back.

Mr. Doyle. I thank the gentlelady.

Let's see. Ah, I see my friend Mr. Kinzinger is back. Adam, you have got 5 minutes.

Mr. Kinzinger. Thank you, Mr. Chairman. I appreciate all the witnesses for being here.

Let me start with Federal coordination on spectrum. So, Mr. Donovan, when the FCC evaluates spectrum for commercial use and conducts an auction, don't potential bidders rely with investment-backed expectations on the regulatory structure that the FCC adopts when deciding whether and how much to bid on spectrum? Is that a yes or no?

Mr. Donovan. Absolutely, yes.

Mr. Kinzinger. So I raised concerns that there have been efforts by Federal agencies to upend FCC decisions either on the brink of or even after FCC auctions. For

example, that effort occurred in regard to the 24 gigahertz with NOAA.

Mr. Donovan, shouldn't all of this be worked out as part of the FCC-NTIA coordination process, and doesn't it undermine confidence in FCC decision-making to have these 11th-hour changes?

Mr. Donovan. Yeah, absolutely. You know, it is fair for different agencies to express concerns, to raise real issues that need to get worked out. But once that is worked out and the spectrum is brought to market and purchased by commercial carriers, you should be able to use it the way that you bought it. You wouldn't buy a house and then afterwards be told, well, you don't get access to two of the rooms in it. You wouldn't have paid for that house that way.

It all goes into the evaluation. And we really risk lacking confidence in the very successful auctions program if we continue to raise concerns after the fact.

Mr. Kinzinger. Thank you.

So I want to shift to Open-RAN. Today, the U.S. and its allies have significant economic and national security risks associated with one company, Huawei, providing a closed end-to-end RAN solution.

I will soon reintroduce the bipartisan Transatlantic Telecommunications Security Act, which authorizes the U.S. Development Finance Corporation to provide financing for secure 5G telecom infrastructure for our European allies and partners.

China is not to be trusted and, moreover, if anything happens to Huawei, they represent a single point of failure for our smaller rural carriers.

As I understand it, an Open-RAN approach could provide the U.S. and its allies an opportunity to develop a long-term alternative to Huawei. As a member of the House China Task Force, I know how Beijing competes in business. Either they steal technological developments or they heavily subsidize and capture market share.

In the wireless industry, they have done both. So it is vital that we have a strong bipartisan response and not cede U.S. leadership in wireless. I believe Open-RAN could be a critical part of that response.

So, Ms. Rinaldo, could you briefly discuss why diversifying the supply chain is so critical to our national security, and do you believe companies in the U.S. and allied countries may be poised to lead in this effort?

Ms. Rinaldo. Thank you, Congressman, for the question and for your leadership on this issue. Yes, when I was former head of NTIA and would talk with my counterparts around the world, I would ask why they would choose one vendor and not another, and they all gave the same exact answer, cost.

If we are able to drive competition, create innovation, and lower cost, that is a game-changer not only for the United States and our manufacturers here, but for the allies around the world.

Nobody wants to choose an untrusted vendor, but if you are looking at the difference between being in the black and being in the red, there are serious decisions that need to be made. If we are able to change the tables and not make cost a factor, countries are going to make the right decision.

Mr. Kinzinger. Thank you.

Mr. Amin, we hear a lot about the benefits of Open-RAN, but everyone seems to talk about it like it is just an idea, and you are actually running a network based on these technologies. While we think we are getting ahead, after hearing what you have deployed in Japan, I feel as though we may actually be falling behind.

Can you speak to where the U.S. market is relative to Japan and, more importantly, where do you see American wireless innovation relative to China?

Mr. Amin. So thank you very much, Congressman. I think I just want to

highlight that what we have done in Japan now is deploy at scale with over today 18,000 Macro Base Station 4G running on a completely Open-RAN platform architecture.

We have taken the fear and uncertainty and doubt and the merit about such an advancement in telecom architecture from concepts to reality in about a year and a half. And I think we see that the potential for such a technology is just absolutely enormous.

We have met with many CFOs in the last 18 months to explain to them across the world the advantages of such technologies and why they need to embrace this journey that we have undertaken.

And one of those key things and tenets for us is to even maybe shed light to U.S. companies about the available pieces of this puzzle, from component vendors that are I think one of the most creative in the world that exists in the U.S., and what is required is really now tying the pieces together and deploying this.

You have asked a very good question. How does the U.S. compete against China? I have no doubt that the software capability that exists in the United States is just remarkable. I think the focus and the effort around creation of a credible supply chain for chips, including manufacturing in the U.S., I do believe this is really vital and especially for countries like Japan. We rely very heavily on supply chain that exists from many of our partners in the U.S. And I think that the work that is being done on the supply chain for silicon is going to have a lot of value to the future potential of this technology.

Mr. Kinzinger. Thank you. I yield back, Mr. Chairman.

Mr. Doyle. The gentleman has yielded, expired.

Let's see. The chair recognizes Ms. Clarke for 5 minutes. You need to unmute.

Ms. Clarke. Yes, I am here. Thank you very much, Mr. Chairman and Ranking Member Latta. I appreciate today's hearing. It has been extraordinary. And I want

to thank you for convening today's -- I am sorry, I am having a little bit of technical difficulty here.

I want to thank you for convening today's hearing. The topic is critical to the work the Energy and Commerce Committee has been doing to advance our national priorities and technological advancement, economic competitiveness and national security. I would like to also thank our witnesses for virtually joining the committee and sharing your testimony addressing both the challenges and areas of opportunity concerning the supply chain of our wireless infrastructure.

As chair of the Homeland Cybersecurity, Infrastructure Protection, and Innovation Subcommittee under the jurisdiction of the House Committee on Homeland Security, creating a secure 21st century digital infrastructure remains a critical priority.

As we continue to chart the path toward recovery from the COVID-19 pandemic and seek to modernize our Nation's infrastructure, we must not forget the vital role that wireless infrastructure plays, ensuring connectivity for all Americans, equitable access, and essential resources in today's digital reality.

My first question is for Ms. Rinaldo.

Ms. Rinaldo, COVID-19, the COVID-19 pandemic has proven that underresourced and marginalized communities depend heavily on wireless connectivity to remain connected and integrated in society. For many, wireless is the primary form of access to critical resources, such as telehealth services and virtual learning.

How might implementing Open-RAN impact both access and affordability of wireless services in urban and rural areas?

Ms. Rinaldo. Thank you, Congresswoman, for this important question. I would say that as Open-RAN technologies are rolled out as well as 5G converge that both of these things are impacting underserved communities in an incredibly positive way. If

we are able to lower prices by 30 percent using Open-RAN technologies, you all of a sudden have a business case of why carriers can build out in these more underserved areas.

As well as with bringing 5G online, there is a case study with smart ag -- agriculture, excuse me, as well as a whole host of other activities that are going to bring 5G out to the more rural areas. Now, what do we do with that extra capacity? Able to provide in-home broadband, which will impact these underserved areas. I have great faith that as we move forward with Open-RAN technologies as well as 5G that it is going to raise all boats.

Ms. Clarke. Wonderful. Mr. Donovan, how does the current dependence on foreign suppliers for the network supply chain impact security of the broader U.S. telecommunications network infrastructure?

Mr. Donovan. Thank you. So any time that you are relying on foreign providers, you don't control the whole process end to end, from the network equipment on down to user devices to even the components of that, to the screens, the circuits, the antennas. And all of those create potential for concern in the supply chain. So the more the supply chain that you can control from end to end in a trusted manner allows you to have confidence in the product.

And to your previous point, I couldn't agree more the importance of focusing on mobile and wireless services as we talk about infrastructure. There are so many applications that can only be met by mobile, while also having the side benefit of being able to provide fixed wireless access connectivity while waiting on building out fiber to other markets.

Ms. Clarke. So just to follow up, Mr. Donovan, why is Open-RAN a good path for addressing these security concerns?

Mr. Donovan. If Open-RAN can prove that it has security advantages as well as domestic providers, then you can control more of the supply chain here. I think that is why there is so much interest in this technology.

Ms. Clarke. Mr. Baker, in your testimony, you explained that Open Radio Access Networks would allow the use of some components from a variety of suppliers, thus opening the door for innovation through competition. As co-chair of the Smart City Caucus, I am an advocate for expanding smart infrastructure.

How might a cloud-native 5G Open-RAN network in the United States advance the goal of making our communities more resilient and efficient?

Mr. Baker. Thank you, Congresswoman Clark. The great thing about Open-RAN and the virtualized network is I can make elements or make networks that are very small or very large. And one big application that is coming out of Open-RAN virtualized networks is the enterprise space. And to that extent, that shows that I can build a complete wireless network on a single server, using U.S. technology and radios that have been placed around the building like WiFi access points.

So the technology scales, multiple sources, and I can build innovation parks, factories, offices, smart hospitals, et cetera, et cetera, from the use of open and interoperable technologies.

Ms. Clarke. We are running out of time. I yield back. Thank you, Mr. Chairman.

Mr. Doyle. Thank you.

The chair now recognizes the gentleman from Oklahoma, Markwayne. You have 5 minutes.

Mr. Mullin. Thank you, Mr. Chairman.

Mr. Amin, you spoke in your testimony that when you first joined Rakuten that

you withdrew your company from a deal with a Chinese equipment vendor. Can you expand a little bit on that for me.

Mr. Amin. So the business model for Rakuten prior to me coming in was really looking at an opportunity to lower the cost burden, as I think others spoke in this forum. And one of the suppliers was, of course, a Chinese equipment supplier.

And when we looked at the cost and economics of the network platform that we had built in Japan with new Open-RAN architecture, completely embracing cloud-native platforms not only for radio, for core, we really proved that we could get our costs and economics to be even lower than what is being offered by Chinese equipment suppliers. And to that extent, we have taken decisions decisively that we wanted to secure this network as number one particularity.

Mr. Mullin. So you are saying you didn't feel secure with using their equipment?

Mr. Amin. No. I mean, we felt that we did not have complete access to all the interfaces in any of the network components, and we needed to secure this for us to protect our consumers in Japan and make sure that there is no security vulnerability in the platform architecture.

Mr. Mullin. So we know companies understand this. So why are they continuing being attracted to Huawei or ZTE? Is it just price?

Mr. Amin. It is not just price. I mean, let me give you my view. Look, I think in the last decade I have no doubt that also Huawei and ZTE have really evolved and advanced their technology. So I think if you looked at them in the past, maybe the story would be different. Cost has become the entry point. Low cost was an entry point.

But most global operators today cannot have a clear visibility to what is really the alternative. And this is, frankly speaking, what we have been trying to champion now is an option, an alternative to what exists as traditional vendors in the marketplace.

So I think, you know, the simple answer is, they now need to learn and understand that the world has alternatives. And I think discussions such as today is really critical not just also for the U.S. but also global marketplace.

Mr. Mullin. So you don't think it solely has to do with price?

Mr. Amin. I mean, I think price, of course, comes in, but there is no credible alternative that they could go to today that they could say, I could meet the same price factor as Huawei and ZTE would give me.

Mr. Mullin. Right.

Mr. Baker, how can we ensure that trusted vendors can become competitive with Huawei and ZTE overseas?

Mr. Baker. Good question, Congressman. I think, you know, simply funding the Telecommunications Act and getting funding out there, but doing research and bringing radio technology back to the U.S. is strategically important.

When you compare Huawei technology with Nokia and Ericsson, for instance, you know, Huawei's radio technology is actually better performing in terms of power efficiency. When you look at all of the issues that we have with, you know, the size of the power grid for the United States, you know, if we just addressed the efficiency of power amplifiers that are used on towers today then we would see significant savings in energy on the power grid. So research in radio, fundamental radio technology will help us along.

Mr. Mullin. John, excuse me for using your first name, but I am not going to try to pronounce your last name here. Do you want to elaborate any more on that?

Mr. Mezzalingua. Yes. I think that I support John's points. And I think that when it comes down to it, a lot of conversation has been centered around standards and how do we compete and what is it going to take to influence standards.

And it is important to appreciate that standards are a byproduct of research and development. Once you understand how deeply technology works then you can then, of course, influence standards. It also is impacted by real life application. You learn things as you are involved in the field of play.

So I think that that all relates directly to this Telecom Act that we have been talking about. It is going to take time, so urgency is the name of the game.

Mr. Mullin. Right.

Mr. Mezzalingua. But that is my view. It is Mezzalingua, by the way.

Mr. Mullin. Thank you. Well, you would tell me and I still would have a hard time pronouncing it. It is not something we get used to saying all the time in Oklahoma, but I appreciate it.

Anyway, guys, hey, I appreciate everybody on the panel. I definitely appreciate your expertise on this. And, you know, in Congress we are trying to wrap our head around it, and taking the time to educate us means the world.

And, Chairman, I appreciate you holding this. This is a true bipartisan hearing that we don't always get to have in Congress. So, with that, I yield back, right on time.

Mr. Doyle. Thank you, Markwayne.

Let's see. The chair recognizes the gentleman from California, Mr. Cardenas, for 5 minutes.

Mr. Cardenas. Thank you very much, Mr. Chairman. And thank you for having this important hearing.

I really appreciate all of the experts and people from industry with your opinions and apprising us of what is really going on out there today and, hopefully, what can improve when it comes to the world of Open-RAN and 5G and all the things that Americans hear about but, unfortunately, most of us don't understand the details. So

here we go.

Thank you for all that you are doing to help remind us how important this is, not only to American jobs but, more importantly, in my opinion, security for American business, for the American economy, for American individuals and families.

And I want to first ask the question, can one of you explain to me why would the American government be concerned about Huawei being in any way portions of the elements of our system here in America?

Mr. Donovan. Congressman, if I can start with that.

Mr. Cardenas. And then we will go to Diane. Go ahead.

Mr. Donovan. Okay. In terms of competition internationally, when we are talking about 5G we are looking at what some studies show, that by 2035 a market as large as $13.2 trillion in global economic output. That is huge. It is critically important.

Mr. Cardenas. Is that a per annum or is that a set amount over a decade?

Mr. Donovan. That is per annum of what they are expecting by 2035 --

Mr. Cardenas. Thank you.

Mr. Donovan. -- with all the ways that 5G is going to be involved in in our daily lives. So it is critically important that the United States lead the way.

Mr. Cardenas. Thank you. Diane. I am sorry, Ms. Rinaldo.

Ms. Rinaldo. No, you are fine. Diane is perfect.

I would say that Congress has been sounding the alarm for 10-plus years now that there are concerns with using untrusted vendors in our telecommunications networks.

At the Open RAN Policy, we are discussing the other side of that coin, the economic security side of that coin. If not them, then who? How do we ensure a more robust and diverse supply chain not only here in the United States but for our partners around the world if we are to only go down to a handful of suppliers.

Mr. Cardenas. Well, there was a famous line in a movie way back when there was a phone call and then all of a sudden the person says the phone call is coming from inside the house.

Is that what we are talking about with Huawei and our security as a Nation and economically, that for Huawei to be in elements of our system that will be part of our infrastructure today and going forward that a country like China and a company like Huawei could potentially cause issues for us, you know, on an individual basis and also when it comes to our overall economy.

Ms. Rinaldo. Yes. And that has been the longstanding concern of U.S. politicians is, what do we do if they are in our networks and if there is ever a problem? I think the United States has done a phenomenal job of not only making this known, but working with industry to ensure that this is remedied.

I think now that we need to turn our eyes to our partners around the world and how we can help them support their decisions as they move forward. And I believe Open-RAN is an important part of this conversation.

Mr. Cardenas. And it goes without saying that there are trusted partners and there are partners that we have good reason not to trust.

Ms. Rinaldo. I would say that is correct.

Mr. Cardenas. Thank you.

Mr. Donovan, we need to make sure that smaller cost-sensitive carriers like your member companies can take advantage of Open-RAN networks. What can we do, the Federal Government, what can we do to make sure that companies like those are not left behind?

Mr. Donovan. Continued investment in mobile networks, especially where the smaller operators provide service, is going to continue to be important. And for all the

talk that we have had today of ORAN, one of the real key pieces that we haven't focused on as much is having a core that is open and compatible with that.

And for smaller operators that don't have greenfield operations that you have networks in the field today, getting a core that is compatible with that that can continue to sustain their existing network can open up additional options like those provided by ORAN providers to continue to evaluate all technologies.

Mr. Cardenas. Thank you. Go ahead, please.

Mr. Baker. Open cores are available today. Mavenir has been a pioneer of virtualization and working through open interfaces. So core networks are virtualized today and are available. And the great thing about virtualization is that they scale to give small virtualized elements that are cost-effective and support these rural markets.

So a lot of this is about education and training and giving the rural carriers time to make the correct decisions.

Mr. Cardenas. Yes. Having to reinvest, reinvest, reinvest from scratch is not a system that would work anywhere, certainly not here or anywhere else and it wouldn't have a future.

So being that I am out of time, thank you, ladies and gentlemen, for all of your information and wisdom.

I yield back.

Mr. Doyle. The gentleman yields back.

The chair recognizes Mr. Walberg for 5 minutes.

Mr. Walberg. Thank you, Mr. Chairman, for a really helpful hearing. And to the panelists, thank you for sharing your expertise.

In order to be secure, I think, as we have discussed today, it becomes clearer all the time that we must protect our networks against outside threats, both tangible and

intangible.

One of these intangible threats and I believe a vital piece of securing our network and ensuring U.S. wireless leadership is the lesser known but critical global standard-setting bodies.

These independent, business-led entities determine the standards by which 5G operators, equipment manufacturers, software providers and others build to and specifications.

Participants in 5G international standard-setting bodies have noted less and less participation from Western and U.S. companies and increasing participation, as to be expected, from Chinese companies. This raises security and competition concerns as China seeks to assert its influence and skew international standards for 5G toward Chinese-controlled telecommunications companies and their technologies.

We wish and need, I believe, to push back to ensure U.S. leadership in 5G, but also in 6G and successive standard releases. That is why I am pleased to be reintroducing soon, with my good friends Congresswoman Dingell and Congressman Bill Johnson, the Promoting U.S. Wireless Leadership Act.

This bill encourages participation by trusted companies, both large and small, and international standard-setting bodies, like 3GPPP and also IEEE. Our bill reflects the need for a unified approach to pushing back against international competitors like Russia and China to protect U.S. national security, global competitiveness, and cost-effectiveness in wireless communications.

Along those lines, Ms. Rinaldo, as former NTIA acting administrator, you are involved with the ITU and other global technology standard-setting bodies. From your purview, how important is it for the U.S. to participate in leading these bodies, particularly when it comes to interoperability and security?

Ms. Rinaldo. Yes, Congressman, you are absolutely right. Not only do we need additional U.S. Government participation, but private sector participation as well. But I think you hit on a very important point with your legislation.

During my time at NTIA, the White House ran an interagency process to determine who was going to lead at 3GPP. After the process it was determined that NTIA, the Telecom Administration, was the right agency. We should not have to relitigate this every time a new session comes about.

The NTIA should be permanently made the designation for the United States Government. They have the expertise, and it is important to nurture the expertise at one organization as well as to create history for sessions to come.

I would also say that we need to reexamine how the United States Government works with the private sector. It is so important that we better coordinate and we break down hurdles to having those types of conversations. I would gladly work with you and your team on some of my ideas.

Mr. Walberg. I appreciate that and I certainly agree.

Mr. Baker, does Mavenir participate in standard-setting bodies and, if so, could you describe what it takes to participate, time, money, resources, et cetera?

Mr. Baker. Congressman Walberg, thank you for the question. Yes, you know, we believe global standards are critical to the success of Open-RAN and are going to greatly impact on whether we have a diverse supply chain.

The bottom line is the U.S. needs to be involved in global standards and so the rules of the game, we aren't written out by not being there. To that extent, you know, we need to match the levels of funding that the Chinese give with respect to U.S. companies, both private and open, and be at the table for the standard-setting processes.

Mr. Walberg. Thank you. On a separate but pivotal issue, Mr. Donovan, what

kinds of skills are needed for the next generation of telecommunications operators and workers to deploy new wireless network technology such as ORAN or vRAN? We have got a lot of good jobs in putting up towers and all sorts of high-paying jobs there, but radiofrequency and [inaudible] for instance, are issues of concern. What could you add on that?

Mr. Donovan. I agree. We need to increase the pipeline of skilled telecommunications workers. There is huge demand today. That is only going to grow. And I thank you for your work with Congresswoman Clarke on the Telecommunications Skilled Workforce Act. I think that is a really good idea.

Mr. Walberg. My time is expired. I yield back. Thank you.

Mr. Doyle. I thank the gentleman.

Let's see. The chair recognizes Mrs. Fletcher for 5 minutes.

Mrs. Fletcher. Thank you so much, Chairman Doyle. And thank you to you and Ranking Member Latta for holding this important hearing today and to all of the witnesses for taking the time to testify. The hearing has touched on a lot of important issues, issues that the COVID-19 pandemic has highlighted over the last year, as we have seen the need for high-speed broadband to connect workers to jobs, students to online resources in every single community across our country.

Congress has answered that call by providing significant broadband funding in recent relief packages, and hopefully there will be additional support in future infrastructure legislation. I know that is important to so many of us. And there are so many stakeholders in the mission for full broadband development.

In my hometown of Houston, we are working to lead the way in 5G broadband deployment, investing in needed infrastructure, small cell, and, following up on something Ms. Rinaldo just mentioned, working closely with the private sector to become

a leader in the State.

The city's technology investments will be a huge economic driver for our region in the years to come. And our mayor, Sylvester Turner, who testified before our committee on the Texas power grid just a few weeks ago has made deploying 5G infrastructure to underserved communities a priority for his administration.

5G broadband can help bridge the digital divide by allowing low-cost, high-bandwidth services to stimulate the growth of small businesses and education in the areas that need it the most. I think we all understand the benefits of faster internet speeds and what they allow people, adults and children alike, to be able to accomplish and can be absolutely transformative.

I want to make sure that our local communities have the resources they need, given their significant role in 5G broadband development. Whether because of the economic impact of the COVID crisis or the increasing pace of deployment, local governments are facing new challenges in managing permitting applications.

So, Mr. Donovan, can you discuss how this challenge and how Congress might be able to help in addressing this challenge and support local communities in broadband development?

Mr. Donovan. Absolutely. So thank you. And you have a great example in your district. You know, as cities and municipalities can take steps to be 5G ready, it can really be a win-win. It makes it easier for the industry and operators to invest and bring those services, and then the residents enjoy the benefits of having expanded reliability and further investment. It has downstream benefits of making sure that excess resources aren't spent in certain markets and then there is nothing left to build out to rural areas.

So I appreciate Congress' focus on keeping broadband as an eligible service, as

funds have been provided to States and municipalities in recent legislation. Looking forward, if there are ways to provide grant funding so that cities can become 5G ready to make it so that it is, you know, an all-incentives approach to work together, that can be a real win-win, especially as municipalities are facing an increased workload of permitting applications coming in with 5G at the same time as existing resources and staff have been really pushed to the max. So funding like that to reward cities for taking steps to become 5G ready could be a real positive for everyone.

Mrs. Fletcher. Right. Thank you so much, Mr. Donovan, for those insights.

Would anyone else on the panel like to speak to this and what we can do to help support local communities in broadband deployment?

Mr. Baker. Yes, certainly. I think one of the factors that gets overlooked with Open-RAN is that the new architecture allows you to minimize the equipment that is actually at a cell site. So it actually reduces the amount of zoning square footprint that is needed by putting a lot of the technology actually into the data centers and using, you know, fiber connection straight to the radio on the tower.

So Open-RAN offers the benefit to go back and look at how these sites are engineered in the future.

Mrs. Fletcher. Terrific. Thank you, Mr. Baker.

Anyone else like to speak to this with the few seconds I have left?

Mr. Mezzalingua. Yeah. I would just say, Congresswoman, thank you for your question. The government has, through its CARES Act, stimulated a lot of this. We have been dealing with this digital divide issue for far too long in this country. It has been decades. And we can actually solve it now, but in a highly efficient way, the way that has been described here.

So I would echo the comments about software. I would just encourage that it be

part of a funding and viewed as infrastructure, because it is a form of national security that is let's say outside the classic definition when you think about how critical it is in today's everyday use of all of our lives.

Mrs. Fletcher. Perfect. Well, thank you so much, Mr. Mezzalingua, for that insight, and I do appreciate. We are thinking of new ways in this Congress, and that is an important thing to remember.

So thank you so much, Mr. Chairman. I yield back.

Mr. Doyle. The gentlelady yields back. The chair, let's see, Buddy, I see you there. Buddy Carter, you have 5 minutes.

Mr. Carter. Thank you, Mr. Chairman.

And thank all of you for being here. This is an extremely important subject, and we just can't tell you how much we appreciate your help here and you being here.

Mr. Baker, I am going to start with you. Mavenir has taken a leading role on developing and deploying ORAN technology, including in your work with Dish. What have you seen? What has been your experiences as far as the largest hurdles to develop a viable ORAN network?

Mr. Baker. I think, having built many networks globally, that we see the same sort of challenges. And it is all about coopetition, if you like. And I term it that way because Open-RAN is about open interfaces, people working together to test those interfaces, people working together to test software. And the success of the future is about companies collaborating, but also competing.

And I think as we level the playing field here, you know, with open interfaces you are going to see a lot more of that. And, you know, Mavenir has taken a very solid stance about helping the ecosystem, working with competitors, testing their products, ensuring they are ready for market, but with no restrictions on where they sell. So, you

know, they take the experience and they pass it on to the next vendor. And so, hopefully, this will grow across the world in terms of how networks are going to be built in the future.

Mr. Carter. You talk about future-proof I believe is the word you used, future-proof networks against foreign interference, especially with rural carriers. As they work to update their equipment with trusted equipment, how can we, as legislators, how can the U.S. Government work with smaller companies to participate in standards, in the standard-setting process?

Mr. Baker. Yes. So, you know, obviously, as I said earlier, standards are fundamental to the process and being at the table and actually being part of that decision-making, so you know what is in the standards and you are not being written out.

Underneath it, you know, once the standards are produced and shown to be interoperable -- and that is the key message, that they must be open specifications and they must be interoperable.

And then once you have got to that point, then smaller companies can participate, you know, with a smaller level of investment to develop those products tat the rural carriers or, you know, some niche segment of the marketplace can use.

You know, the great thing about Open-RAN is you don't need to be a complete end-to-end supplier to actually participate.

Mr. Carter. That is great. Thank you, Mr. Baker.

Ms. Rinaldo, I want to ask you, the shift to ORAN, what does that mean for barriers to entry into the wireless industry?

Ms. Rinaldo. Well, I think what we have seen over the past 20 years in the vendor community, there has been so little venture capital money, because the barriers for entry has been so high. By standardizing the interfaces, we have already seen so

many new startups have come into the marketplace.

If you were an engineer and had the best, greatest idea for a radio and you could only sell your product to a handful of companies and you have a 10-year lifecycle, are you going to put all your energy into that radio or might you look somewhere else? But now all of a sudden, you can sell to carriers, private networks. Your pool of customers has grown exponentially.

And, again, what we have seen is the additional competition in this space is spurring innovation as well. So competition equals innovation, and it is going to bring cost down at the end of the day.

Mr. Carter. Well said. Thank you. Hooray. That is great.

Let me ask you, you also mention in your testimony how development of ORAN can help spur on bilateral cooperation with our international partners. Other than Japan, where do you see the biggest room for growth?

Ms. Rinaldo. Absolutely. I would say that this is one of the most important points that we focus on at the coalition. It is not enough just to bring Open-RAN to the United States. We need global markets. We need our partners.

I think the most focus right now for the coalition, of course, has been Asia but as well as the European Union and Africa. We want to ensure that the developing nations around the world who are struggling with 3G are able to make decisions based on quality and not on cost.

So working and partnering with our partners who are in a place similar to us where they are deploying 5G, we can possibly put together our not only collective mind power, but most developed nations have funding to help assistance in developing nations by pooling that funding with the --

Mr. Carter. Right. And finally --

Ms. Rinaldo. Sorry. Go ahead.

Mr. Carter. I am sorry. Finally, I have one last question if I can squeeze it in. Why is it so important that NTIA remain the leader in spectrum policy?

Ms. Rinaldo. Absolutely. NTIA is absolutely the right agency. They have the expertise. They have been doing this for 80-plus years. It is important to have a tight process where everyone has a voice at the table. Decisions are made based on fact and science, and we need to be decisive. And when a decision is made, we need to come together as a country and speak with one voice. This is the only way to make progress.

Mr. Carter. Sounds wonderful. Thank you very much.

Thank you, Mr. Chairman. I yield back.

Mr. Doyle. Thank you, Mr. Carter.

The chair now recognizes Mr. Welch for 5 minutes.

Mr. Welch. Thank you, Mr. Chairman. You know, the adoption of ORAN can present challenges to smaller providers. I am really concerned about rural America. And a lot of the funding that is out there doesn't necessarily help them, those small ones, switch their own network equipment to ensure that components are compatible.

And, Mr. Baker, I want to ask you, what do you see as the practical challenges that this, what we are talking about would impose on rural carriers and their ability to continue to improve service for rural Vermonters?

Mr. Baker. Thanks, Congressman Welch. Good question. A lot of the challenges, if you like, around rural carrier adoption is actually the learning process and getting their confidence up, in terms of the new pieces of the technology.

And, to that extent, it is worth pointing out that, actually, the only piece that is new in all of this is the open interfaces and the compute hardware that is used for processing the radio signals. The radios are identical. The RF planning is identical.

But, again, it is just getting that confidence level that they get the quality of service.

And companies like Mavenir, you know, we are standing up. But being that one [inaudible] and doing, you know, putting the integration services there as this market evolves. So there should be no lack of trust, if you like. You know, we can't do that job. You know, we have built some of the largest core networks in the world.

Mr. Welch. What about on the expense side? You know, in all of these situations where you have to upgrade for whatever reason, the bigger companies that have more market share and more market power always have an advantage, because they can absorb and spread the cost, but our smaller providers which are dedicated to the local consumer can't.

So can you address that concern I have, because it is something that has repeated itself?

Mr. Baker. Absolutely. And we have demonstrated this in the core networks today. And, you know, Mavenir is supplying small cores and large cores. The great thing about virtualized technology is you can build a complete network on one server and for a few thousand dollars end up with a complete network and a radio.

You know, that is taking it to the extreme, but in the sense that they are getting the benefits of very high volumes of compute platforms.

They are getting the benefits of the virtualized experience, if you like, that is gained already from the cores of mobile networks. And then their ability to have lower operating costs in terms of site visits. Everything is downloadable. And as Tareq said earlier, it is all about automation, how you bring automation to bear.

Mr. Welch. If very small rural carriers ask me, Peter, you know, how is this going to affect our bottom line, you are telling me I can say that you will be okay?

Mr. Baker. Absolutely. And, you know, as Tareq said from Rakuten, they have

seen the experience of our product costs. We know, you know, we physically see it every day in the products we deal with that the products are cheaper and more cost-efficient.

Mr. Welch. All right. Thank you.

I yield back, Mr. Chairman.

Mr. Doyle. Okay. The gentleman yields back.

Let's see. I think Mr. Duncan is next. Jeff, you are recognized for 5 minutes.

Mr. Duncan. Thank you, Mr. Chairman, and thank you for this, your leadership and the ranking member's leadership on this important issue. We are right here near the end, guys. So I know a lot of questions have been asked already, but I just want to point out as an example of bipartisan where we can work together on an important national and economic security issue, and I look forward to working on this further.

The pandemic has exposed the need for us to expand domestic manufacturing capabilities across all industries so we are not reliant on foreign suppliers, especially when that foreign supplier is from communist China.

So I want to ask our panelists here -- really, I will start with Mr. Baker, I guess -- how do you view the threat of Chinese parts on our telecommunications system, especially as it relates to the potential for American businesses and citizens to have their data stolen and rerouted to China? Is this an opportunity for Chinese espionage?

Mr. Baker. Clearly, there is always an opportunity. But then the other side of it is, you know, it comes back to the point about zero trust in any of the components and elements that we use within our products.

To the extent that they, you know, could be fully security tested, continually monitored, you manage the supply chain and then you, you know, just take a zero trust philosophy across all of the products, software development, et cetera, et cetera, to

ensure that the example as you gave doesn't happen.

Mr. Duncan. I will ask Ms. Rinaldo the same question.

Ms. Rinaldo. Sorry, Congressman. It is the tech people that always struggle with the mute button.

Yes, we want to ensure that we have trusted supply chains going forward. And a big part of that is ensuring that there is additional competition so consumers, operators have choice. And that is what we are discussing today, how to bring additional competition to bear.

The coalition doesn't -- we are not here supporting any one company or any one technology. Our message is simple: If you break down the barriers for entry, you are going to drive more competition.

Mr. Duncan. Is this an opportunity for Chinese espionage against national security-sensitive systems or our military?

Ms. Rinaldo. So there has been a long concern within the U.S. Government as well as Congress about Huawei and other companies in our telecommunications networks. There have been multiple instances where intelligence officers have made public statements as such. At the coalition, we focus on the other side of the coin, the economic security side of the coin. If not them, then who?

Mr. Duncan. Yeah. Mr. Baker, do you think that is an appropriate statement?

Mr. Baker. Yes, I do. And, again, you know, it comes back to processes and the interfaces. And then there are the security test houses that will grow out of those open interfaces as well to keep a watch on the products.

Mr. Duncan. There are two things I want to know, and you have answered most of these today, but how can Congress assist and help the industry move forward or in the direction of greater domestic production.

The second thing is, should that also include mining, production, finishing of critical minerals that go into these products? Mr. Baker?

Mr. Baker. Yeah. I think the challenge that, you know, we all rely on silicon and obviously the CHIPS program, bringing chip manufacturing and that back to the U.S. But, you know, at the end of the day, it is where the fundamental resources are coming from in terms of, you know, actually getting into the silicon chip.

So, you know, at the end of the day we need the supply chain back in the U.S. and controlled in the right way.

Mr. Duncan. Ms. Rinaldo, the part about what can Congress do to move us in the right direction for domestic production, what can we do more of?

Ms. Rinaldo. Yes. At the Coalition, we support fully funding the USA Telecommunications Act, which you passed last year. The $3 billion will go a long way to ensuring not only domestic manufacturing, job creation, and research and development in the United States, but as well provide the Secretary of State assistance to help developing nations around the world.

We also focus on public-private partnerships, how the U.S. Government and the private sector can work together, and international cooperation.

Mr. Duncan. That is great.

Mr. Chairman, the only thing I will say last before I yield back the balance of my time is that we need to think about the critical minerals, those elements that we have available here in this country but we have off limits for mining. And we are reliant on China for so many of those rare earths, and this committee ought to think about that, maybe in conjunction with the Natural Resources Committee.

With that, I yield back 18 seconds.

Mr. Doyle. I thank the gentleman.

The chair now recognizes Ms. Kelly for 5 minutes.

Ms. Kelly. Thank you, Mr. Chairman, for holding this hearing today. We are at a critical juncture where we will decide America's leadership on 5G infrastructure.

Mr. Baker, in your testimony, you mentioned the window of opportunity is closing. In your mind, when do you think it will close and is the U.S. supply and demand robust enough to be successful at its current pace? You also proposed financial investments generally. Would pulling certain levers be more useful, given the closing window?

Mr. Baker. A good question, Congresswoman Kelly. You know, we are not -- you know, we don't want to pick winners and losers in all of this. That is the most important point of this. But certainly, you know, by the legislation that is in place around the rip and replace, where it is diverting decisions to foreign suppliers, essentially is going to exclude any U.S. supplier out of the rip and replace market, for instance.

And then, you know, adoption by U.S. carriers, again, you know, the rest of the world watches what the U.S. carriers do. And they are sitting there saying, well, if the U.S. carriers don't want to use it, why should we?

So, you know, to that extent, there are certain decision points that are going to get to the point of saying, look, okay, you know, U.S. suppliers, you had your chance, but nobody is adopting what you are doing.

And I think this is coming down to how the closed interfaces, the proprietary interfaces are excluding U.S. suppliers from the market. And I think we are at a point, you know, in the next year or so where if we haven't broken the back of this then, you know, we are really then looking at 6G, which is probably, you know, 5, 10 years down the road before there is another opportunity.

Ms. Kelly. Mr. Mezzalingua or Amin, do you have anything to add that you

would like to say about this?

Mr. Amin. I mean, just to reiterate a couple of very important things, I think my own view, going through this now for 3 years, I find that the U.S. has all the necessary building blocks to really build a compelling credible alternative.

I think it is really critical to look at the world in the lenses of why people select alternative vendors such as Huawei and ZTE to manage their deployment of today and tomorrow's technology. We have a great window of opportunity.

By the way, I want to mention that please keep your eye very close on what might happen in Europe in the next 1 month to select this technology of Open-RAN platform. This could be the next large breakthrough that I think we all need to bring an alternative, credible platform with large ecosupply chain that is also coming from the U.S. and its trusted allies.

So I do agree that we have a good window of opportunity. It is closing. But the good news is I think now the attention on this technology and merit of this technology is definitely at the right stage that big, large companies are finally starting to grasp on and jump on on the adoption of such an architecture.

Ms. Kelly. Thank you.

Mr. Mezzalingua. I would simply add that I don't know that anybody knows when, but it is closing and we need to start urgently, because it is going to take time to build these various capabilities that we are speaking of.

And I think at stake is not just our potential U.S. telecom leadership, which is within grasp -- we can return this industry leadership back to the U.S. -- but the ability to control our own destiny, the matters of national security, this outweighs all other elements, in my view. So just reiterating the funding of the act, the Telecom Act, so that we can get going on this and begin this work.

We have shown we can do it. So that is something that is comforting. It is not a dice roll at this point. We have shown we can do it, so now it is time to help accelerate this.

Ms. Kelly. And, Mr. Mezzalingua, while you are speaking, can you go into a little bit more detail on your U.S. Center of Excellence for security standards proposal?

Mr. Mezzalingua. Sure. Our entity that is in Syracuse, New York, is -- well, it was long before there was any discussion of any government support to accelerate this industry. We believe in this, and we are putting our money where our mouth is at a private level. So we believe in the future of this business. We believe in our ability to compete. And so that is why we undertook this a long while ago.

It is going to be a smart factory. So the very same things that we are going to be offering to the DOD and the Marine Corps Base in Albany, Georgia, we are going to be doing in our own facility. So this is possible. I see where the time is up, but this is possible and we are demonstrating it with our own skin in the game. Thank you.

Ms. Kelly. Thank you so much. Thank you to the witnesses and I yield back.

Mr. Doyle. The gentlelady yields back.

The chair now recognizes Mr. Curtis for 5 minutes.

Mr. Curtis. Thank you, Mr. Chairman. I enjoyed the comments of Ms. Kelly and particularly how she pointed out that we don't want to pick winners and losers, and also Representative Welch, who talked about rural broadband providers.

And I would kind of like to combine those two topics to bring up another rural issue, and that is, if not careful, we pick large companies over small companies to be successful. And I have got a great example in rural Utah. Intermountain Electronics is a small business. It is in Price, Utah. It is a town and a county that is struggling economically. We have got this very successful provider of 5G equipment that has a

large footprint and, perhaps more importantly, it employs hundreds of employees in the region.

And I have got a question to Ms. Rinaldo and Mr. Amin: How do we as we move forward make sure that we are successful with Open-RAN and also not hurt our small businesses and make sure they have an opportunity to compete in this? Ms. Rinaldo, yes, if you will go first.

RPTR GIORDANO

EDTR HUMKE

[2:22 p.m.]

Ms. Rinaldo. Thank you, Congressman.

And I know that you are the former mayor of Provo, so these issues are near and dear to your heart.

Mr. Curtis. Yes.

Ms. Rinaldo. I would say that what we are talking about is going to be incredibly beneficial and impactful to your constituent companies. What we are discussing is how do we bring more competition to bear. For so long, there have only been a handful of companies in this space, so, if we are able to standardize the interfaces, we are going to be able to drive additional competition.

If you were to look at our website and go through our member list, you will certainly see some names that you know, but you will see a lot of names that you have never heard of before. And what we have seen is that there has been very little venture capital money in this space because the barrier has been so high. But now we are lowering that barrier, and new companies are coming to bear, so it is going to be certainly a fascinating industry to watch over the next several years.

Mr. Curtis. I am glad you brought up Provo, Utah, because my colleagues probably get tired of me bragging about it, but it is a great case study, I think, in a lot of these issues. And I will just point out that, in Provo, Utah, all residents have access to free internet in the city. It is a pretty amazing situation we have got there. Thank you.

Mr. Amin, will you comment with the same question?

Mr. Amin. Yeah. I think -- I think this is a really, really good question for multiple reasons. I think, if -- if you looked at our action -- and it was very

deliberative -- that we picked a lot of smaller suppliers. I personally feel the smaller suppliers are hungry. They want to prove a point. They could bring a lot of innovations, a lot of disruption.

So the private level, without necessarily a government involvement, we absolutely were very decisive of how we select and pick the suppliers. I think it is extremely critical -- extremely critical that we focus also in the start-ups. We bring VC money back into telecom.

Unfortunately venture capitalists don't like telecom because the barriers to entry is too high, and we are starting now to unravel this mystery for how we bring new money into this industry.

And we are really optimistic, but could not agree with you more that it is just absolutely critical to ensure that we diversify to spend not only on larger suppliers, but go to the smaller companies and reward them for great work and effort to support this endeavor.

Mr. Curtis. Thank you. Let me sort of switch back to Ms. Rinaldo.

Last year, I had the opportunity to serve on our China task force, and we released a report that included recommendations to increase domestic supply chain security, and one of those recommendations was passing and funding the USA Telecommunications Act. I think I have heard you comment on that in this hearing.

But would you just comment on how that funding -- the grant funding will help accelerate 5G development, and, perhaps maybe even more specifically, how it might help our smaller companies?

Ms. Rinaldo. Absolutely.

I would say that this funding is twofold. In the immediate term, we are going to see additional manufacturing jobs, research and development. In the long-term, we are

going to benefit from a sustainable supply chain. We are going to be able to future proof our supply chain in our telecommunications networks, which is going to be so incredible beneficial. It is going to change the way we look at the Gs.

Long gone are the 10-year life cycles where, if there is an issue, something can be immediately updated. So not only in the near term will it help produce jobs and spur manufacturing in the United States; in the long-term, it is really going to lead to incredibly amazing and innovative things for the entire telecommunications industry.

And, as I mentioned in my opening comments, it is no longer about telecom policy; it is about economic policy.

Mr. Curtis. Excellent. I am out of time. But, as I sign off, just a big shout-out to our small businesses who sometimes hoe a more difficult row, and I appreciate all they do to make our economy go. Thank you to our panel and to everybody who has had this hearing.

Mr. Chairman, I yield my time.

Mr. Doyle. Gentleman yields back.

The chair recognizes the gentleman from Florida, Mr. Soto, for 5 minutes.

Mr. Soto. Thank you, Chairman.

Cell phones, computers, and the internet are fundamental to our way of life as Americans. It is also fundamental to our businesses and national security. Yet, American communications are under attack. Chinese are spying on the telecommunications through Huawei. Russians have unleashed an onslaught of cyber attacks, including the SolarWinds breach. These economic rivals constantly threaten us each day in this rivalry on the digital front line, in the battle for liberty and democracy across the Nation.

At the same time, President Biden just recently unveiled the American Jobs Plan,

and it includes research and development for future technologies. $180 billion to upgrade critical technologies and U.S. research infrastructure with a particular focus on research related to semiconductors, advanced communications, and energy technologies.

It also includes a manufacturing piece, 300 billion to strengthen domestic manufacturing in small businesses, with a focus on supply chain resiliency for critical goods and preventing job losses.

In central Florida, we have NeoCity, which develops semiconductors and nanotechnology along with our partner, SkyWater, one of the largest semiconductor manufacturers in the Nation. Their CEO was recently invited to the White House by President Biden. These trusted foundries across the Nation will play a key role in both communications, business, and our national defense.

And, in fact, President Biden held up a SkyWater wafer, a slice of semiconductor used for the fabrication of integrated circuits manufacturing solar cells and substrates for electronic devices in the White House for that visit.

Mr. Mezzalingua, how important will the American JOBS Act's investment in high-tech domestic manufacturing capacity be to boosting both private investment, national security, and our economy?

Mr. Mezzalingua. Well, I think that -- thank you, Congressman, for the question.

Right now, I think the examples that have been discussed previously have shown where we have all made progress. But, in order to accelerate this and make sure that we get out in front of this industry very quickly, it is essential. There is a long -- there is a significant amount of work that has to be done, everything from -- just within the R&D sphere alone, there is a ton of work.

Then there is the supply chain element to make sure that we are not vulnerable or dependent on anybody else. There is the skills that are relating to bringing it all

together. And part of that is training. Part of it is experience. So what this act does is -- there is another -- a number of elements that have to be attacked, and they all take time.

So it is enormously important to allowing us to catch up. But I will say that, in the manner that we are doing it, we can compete, because the nature of the technology is such that smaller companies have an advantage in the sense that software base of all of this -- the software basis has a very democratizing effect, so it can catch up rather quickly. It is not just about large big boxes of factories. Of course you need factories, but, at its core, it is going to be software based.

So I think we have a very -- it is a very -- it is essential to everything that we are doing for the broader mission that we are here for -- here to discuss here today.

Mr. Soto. Thank you, Mr. Mezzalingua.

Ms. Rinaldo, one of your members is in my home State of Florida. Airspan Networks is leading the way in providing open RAN and virtual technology. Can you elaborate how USA Telecommunications Act will benefit domestic companies like Airspan Networks?

Ms. Rinaldo. Absolutely. The money provided by USA Telecom Act will help spur investment in not only Airspan, but other companies across the United States. It is going to help with manufacturing, research and development, for hiring software engineers, as well as provide funding for companies to send their people to standards bodies around the world. I think it is incredibly important not only to be able to participate in these standards bodies, but also to ensure that the United States Government and the private sector can come together to further support the common good of the industry.

Mr. Soto. Thank you so much. This is about protecting our American way of

life. It is about jobs, and it is about our national security, and I hope everyone on this committee can come together for these important efforts, and I yield back.

Mr. Doyle. Gentleman yields back.

And, now, let's see. Last, but certainly not least, my fellow Pennsylvanian, Mr. Joyce. You are recognized for 5 minutes.

Mr. Joyce. Thank you for yielding, Mr. Chair. And I would like to thank you as a fellow Pennsylvanian, Mr. Doyle, and Ranking Member Mr. Latta for allowing me to join on this very important meeting today.

U.S. leadership in the development and deployment of 5G and beyond is crucial. We all recognize this in this hearing. As we continue to battle the Chinese Communist Party for their influence and superiority in this space, we know that we can triumph.

In order to achieve this, we need to put forward policy solutions that foster cutting-edge innovation and foster competition in this space, but we also must be mindful of the supply chain challenges that we face with respect to China. I look forward to engaging with this committee as they look to bring critical production and capacity home or into the hands of friendly allies.

Mr. Amin and Mr. Baker, I have some questions for you. Some of the issues frequently that have been mentioned throughout today's hearing need to be addressed around Open RAN regarding scale, maturity, and integration with existing equipment.

Can you please comment on these issues? Have there been challenges in this regard in your deployments?

Mr. Amin, if you would kindly go first.

Mr. Amin. Thank you very much, Congressman.

Maybe I want to tell you about an interesting story. I haven't had the chance to paint this picture, and I think John talked about it.

In Japan, the moment -- the moment that we have created was to bring vendors that you would consider that they are a competitor against each other, but somehow they both find a way to work and coexist. For example, we have taken Airspan, that makes Open RAN platform, and collaborating with them on building the hardware that is needed for our architecture. We have taken Altiostar that provides a software vendor and worked on system integration and interoperability testing between these two companies.

This model proves that cooperation is very possible, even if the partners and suppliers compete in other geographies and markets.

For Open RAN to flourish, I think the critical thing that we have focused on is to address the complexity of system integration. In our creation of what we call RCP, the Rakuten Communication Platform, we have taken three years of our journey to make sure that we remove the complexities for our future partners and customers to address minimization of the system integration.

And I think it is possible to change the perception about the complexities of deploying Open RAN platforms around system integration. It is an issue that we have to address, and I am very confident, through education and collaboration, this is going to be addressed.

Mr. Joyce. Mr. Baker, would you address this as well, specifically regarding integration with existing equipment?

Mr. Baker. Yeah, sure.

I think we can start off by saying there is a lot of fear, uncertainty, and doubt being spread around in the marketplace around integration of equipment, around interfaces being available, around scaleability, and Mavenir has demonstrated through its life that, you know, you can replace hardware in the core of the network, and you can

build these very large virtual platforms.

And, as an example, you know, we carry 110 million subscribers in T Mobile's network on virtualized platforms, two open interfaces. And the open interfaces on the Core have been there from -- and they still continue coming out of the -- you know, the 3GPP process, and so Mavenir has been able to develop products, two open interfaces, and compete on a world market, gaining 39 percent share of the Core market.

And, now, you know, this is where we come back to the fact that, if we just get these open interfaces into the RAN market, then it gives everybody the ability to compete.

And then this interoperability testing around interfaces will ensure that interfaces follow standards such that, you know, this whole fear about mix and matching products -- and a lot of this has come about because the proprietary interfaces means that, you know, one vendor's equipment today doesn't work with the other vendor.

So, you know, that is an immediate red flag, and that is because the open interfaces are not being followed. Proprietary interfaces are there. And so, you know, the operators avoid this piece of trouble and say, Well, I will just buy it all from one vendor. They throw their hands up in the air and say, I will buy all from one vendor because I know that these interfaces won't work together.

But, as far as the Open RAN, virtualized platforms are concerned, those interfaces are there and fully open to allow these products to interoperate.

Mr. Joyce. I really appreciate the points that you made regarding the interfaces, that they are available, and the collaborative efforts need to occur.

I thank you both for your answers. And, again, I thank you, Mr. Doyle and Mr. Latta, for allowing me to join in to this important meeting today. And I yield my remaining time. Thank you.

Mr. Doyle. Thank you, Mr. Joyce. It was a pleasure having you here with the committee.

So I want to thank the witnesses for their participation today. Not only your opening statements, but the back and forth that we have been allowed to have with you. And the many questions that got answered, I think, gave us a lot of insight into what we need to be doing.

I want to thank my Ranking Member Latta. Also, I think this was a great hearing. I think everybody should take notice that there is bipartisan agreement, I believe, on moving forward. We know this is important to the future, and I look forward to working with my colleagues on both sides of the aisle to move legislation and to make sure that the proper amount of funding gets put into the bills that we need to do to make sure that we move this technology forward.

Now I need to ask unanimous consent to have the following documents put into the record.

A letter from Audubon, Incorporated; a letter from Representative Matsui to President-elect Biden; a letter from Ligado to the Energy and Commerce Committee; letter from Airspan Networks to Chairman Doyle, Ranking Member Latta, Chairman Pallone, and Ranking Member Rodgers; brief from JMA; examples from American Open RAN innovators Airspan, Altiostar, DeepSig, JMA, Mavenir, New Edge, Parallel Wireless, Pivotal Commware, Worldwide Technology; document titled Inseego 5G Born in the USA -- this print is very small -- a white paper from Inseego; research from Inseego.

So, without objection, so ordered.

[The information follows:]

******** COMMITTEE INSERT ********

Mr. Doyle. I want to remind members that, pursuant to committee rules, they have ten business days to submit additional questions for the record to be answered by the witnesses who have appeared. And I would ask each of the witnesses to respond promptly to any such questions that you may receive.

And, with that, the committee is now adjourned.

[Whereupon, at 2:40 p.m., the subcommittee was adjourned.]