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<u>RPTR MOLNAR</u>

<u>EDTR HUMKE</u>

STRENGTHENING AMERICAN COMMUNICATIONS

LEADERSHIP WITH OPEN RADIO ACCESS NETWORKS

WEDNESDAY, JANUARY 17, 2024

House of Representatives,

Subcommittee on Communications

and Technology,

Committee on Energy and Commerce,

Washington, D.C.

The subcommittee met, pursuant to notice, at 2:14 p.m., in Room 2123, Rayburn House Office Building, Hon. Bob Latta [chairman of the subcommittee] presiding.

Present: Representatives Latta, Carter, Bilirakis, Walberg, Dunn, Joyce, Weber, Allen, Balderson, Pfluger, Harshbarger, Cammack, Obernolte, Rodgers (ex officio), Matsui, Clarke, Veasey, Soto, Eshoo, Cardenas, Fletcher, Dingell, Kelly, and Pallone (ex officio).

Also Present: Representative Johnson.

Staff Present: Sydney Greene, Director of Operations; Slate Herman Counsel; Tara Hupman, Chief Counsel; Noah Jackson, Clerk; Sean Kelly, Press Secretary; Emily King,

Member Services Director; Giulia Leganski, Professional Staff Member; John Lin, Senior Counsel; kate O'Connor, Chief Counsel, Communications & Technology; Michael Taggart, Policy Director; Dray Thorne, Director of Information Technology; Hannah Anton, Minority Policy Analyst; Keegan Cardman, Minority Staff Assistant; Jennifer Epperson, Minority Chief Counsel, Communications & Technology; Waverly Gordon, Minority Deputy Staff Director and General Counsel; Tiffany Guarascio, Minority Staff Director; Perry Hamilton, Minority Member Services and Outreach Manager; Dan Miller, Minority Professional Staff Member; Michael Scurato, Minority FCC Detailee; Andrew Souvall, Minority Director of Communications, Outreach and Member Services; and Johanna Thomas, Minority Counsel.

Mr. <u>Latta.</u>   Good afternoon.   The subcommittee will come to order, and the chair recognizes himself for an opening statement.   Again, good afternoon, and welcome to today's hearing to discuss Open RAN technology and the state of America's communications networks.

Wireless connectivity is critical to our everyday lives.   From browsing the internet on the go to precision agriculture, Americans are increasingly reliant on having a wireless connection.

Companies are rapidly deploying and upgrading their networks across the country to meet this demand.

Open Radio Access Networks, or Open RAN, presents a tremendous opportunity for the United States.   Open RAN promotes vendor diversity and competition in the supply chain.

It allows carriers to mix and match equipment from different vendors in their networks so they are not locked into a single end-to-end vendor.

In traditional wireless networks, it can be costly to physically replace components of the network when necessary, whereas Open RAN allows many fixes to happen with a software upgrade.

More broadly, Open RAN will diversify our 5G supply chain, lower equipment costs, strengthen the number of trusted vendors, and help prevent our adversaries from disrupting our networks.

The last time the subcommittee held a hearing to examine the Open RAN marketplace was in 2021, and so much has happened in the last 3 years.

DISH deployed the Nation's first fully open 5G network, AT&T announced that 70

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percent of its traffic will occur over Open RAN networks by 2026, and Congress created the $1.5 billion Public Wireless Supply Chain Innovation Fund at NTIA with over $98 million of which has already been distributed.

American leadership in wireless technology is critical for both economic and national security. American companies, large and small, are leading in developing and deploying Open RAN technology.

Across the Open RAN ecosystem, these companies are developing everything from radios to software, to the system integration tools needed for this technology to succeed.

While engaging with allied partners is a crucial part of making Open RAN a success, we must continue to support the efforts of U.S. companies working in this space to preserve American leadership.

I am grateful that this issue has bipartisan support. This committee has long prioritized securing the communications supply chain and supporting the development of Open RAN technology.

We passed the Secure and Trusted Communications Networks Act to support the rip-and-replace of untrusted equipment from our networks, we passed the Secure Equipment Act to ensure that untrusted equipment is not authorized in the United States, and we supported the creation of the Public Wireless Supply Chain Innovation Fund to support further development of Open RAN in the United States.

We must now ensure that rip-and-replace is fully funded and continue our oversight of the Innovation Fund to ensure that awards are used to facilitate the development and deployment of Open RAN.

I look forward to hearing from our witnesses who represent a cross-section of the O-RAN ecosystem, and I, again, want to thank you all for coming before us today.

And at this time, I now yield to the ranking member of the subcommittee, the gentle lady from the Seventh District of California for her opening statement.

[The prepared statement of Mr. Latta follows:]

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Ms. Matsui.   Thank you very much, Mr. Chairman.

This hearing comes at an excellent time.   Industry is making important steps toward more open architecture, and NTIA is making significant announcements in the Wireless Innovation Fund.

While momentum is on our side, it is important to remember where we started and how far we have come.   For years the United States has lacked a major telecommunications equipment manufacturer, not unlike the decline in the semiconductor industry.

The consequences of this weakness were brought into stark relief due to supply chain shortages and shifting geopolitics.

While the heavily consolidated equipment market has continued to meet the demands of operators, it is clear additional diversity can support a more nimble supply chain while creating lasting, economic opportunities here in the United States.

As networks migrate toward open virtual software defined technologies, there will be new opportunities for companies to enter the market and compete.   By leveraging our existing advantages and high value software and sophisticated workforce, America is uniquely positioned to capitalize on this evolution.

That is why back in 2020, I joined Chairman Pallone, then Ranking Member Walden, and Congressman Guthrie to introduce the USA Telecommunications Act to support the development and deployment of open, interoperable equipment.

It was our bipartisan, bicameral bill that eventually formed the foundation of the Public Wireless Supply Chain Innovation Fund included in the CHIPS and Science Act.

But this provision's inclusion took work.   In May of 2020, I sent a letter, signed by

a bipartisan group of 38 Members, calling for full funding of the USA Telecommunications Act. This show of bipartisan support was instrumental in our push to include this funding in the CHIPS and Science Act.

As a House Democrat lead on the CHIPS Act, I can say with certainty, the CHIPS and Science Act represents one of the most important investments in American economic competitiveness we have seen in generations.

Thankfully NTIA is working to get this money out the door and into the ecosystem with maximum impact. By focusing on development, testing, and evaluation in the first NOFO, I believe the agency appropriately directed resources to the areas that will have the biggest catalyzing impact on the market.

Rather than funding limited buildouts that are unlikely to have broader market impact, testing and evaluation will open doors for small businesses to compete, and this is ultimately what we are looking for -- new market entrants advancing open interoperable solutions.

The NTIA is also doing work to support baseline specifications in the Open RAN ecosystem. Developing a consensus, minimum, viable profile could serve as a turnkey for additional investment and adoption of Open RAN.

But for these specifications to be adopted, it is imperative that there is faith not just in the product but the process. A transparent inclusive process will promote the tide of consensus specifications needed for a true multivendor solution.

And NTIA-led work will also ensure the specifications developed are free from the influence of untrusted vendors like Huawei.

As we work to finish our rip-and-replace work, we should be minimizing the reach of these companies in the burgeoning Open RAN ecosystem. As the Open RAN market

continues to mature, we will have more trusted vendors supplying new options for providers and, by extension, a more reliant supply chain.

Thankfully operators are stepping up to the plate to push the Open RAN market forward. DISH is deploying the world's first stand-alone, Open RAN 5G network. Vodafone is making aggressive build-out commitments, and Japanese mobile operators are proving the technology in the field.

For America to keep place, we must leverage the Wireless Innovation Fund to open doors for new innovators, and that is why today's hearing is so important. I am excited to hear from our witnesses here today, and with that, I yield back the balance of my time.

[The prepared statement of Ms. Matsui follows:]

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Mr. <u>Latta.</u>   Thank you.   The gentle lady yields back the balance of her time.

The chair now recognizes the gentle lady from Washington, the chair of the full committee, for 5 minutes for your opening statement.

The <u>Chair.</u>   Good afternoon, and thank you, Chairman Latta.   America's ability to win the future requires strong communication networks and the ability to lead the development of next-generation wireless technologies.

Fifth-generation wireless technology, or 5G, is already making our networks faster, more powerful, and fueling innovation that is helping connect millions of Americans and devices.

The next iteration, 6G, is still being developed, but promises to do even more. As these technologies become more integrated into our daily lives, we need to ensure that they are safe and secure.

During last week's hearing on cybersecurity, we discussed how foreign actors are increasingly exploiting vulnerabilities in our communications infrastructure in order to carry out espionage, cyber attacks, and other activities that compromise or economic and national security.

We must safeguard our networks from these bad actors.   This requires making sure providers have the resources they need to remove technologies sourced from adversarial countries like China.

Of equal importance is supporting the development of Open Radio Access Networks, or Open RAN, which will help increase competition in the equipment vendor marketplace, leading to greater choice and lower costs for consumers.

Countries like China have amassed a significant share of the global

communications equipment industry and are leveraging this dominance to flood the market, including in the U.S., with cheaper, less secure alternatives.

That includes equipment from companies like Huawei and ZTE, which are controlled by the Chinese Communist Party.

Relying on this technology comes with significant risks. It could be used by the CCP to surveil Americans, steal people's personal information, and even shut down entire networks.

Homes, schools, hospitals, our finance system, and the military are all in in jeopardy as long as this equipment remains part of our communications infrastructure. That is why Congress enacted the Secured and Trusted Communications Networks Act in 2020 -- to remove it entirely.

But that is just the first step. The U.S. also needs trusted alternatives to replace this technology and compete with companies like Huawei and ZTE.

That is where Open RAN comes in. Open RAN enables wireless networks to be interoperable, meaning that operators are no longer forced to rely on a single end-to-end vendor. This allows them the ability to mix and match equipment and services from different vendors, providing new opportunities for trusted companies to compete.

With more trusted suppliers, offering affordable alternatives, operators will be able to end their reliance on companies with ties to the CCP.

Trusted operators around the world and in the United States have already begun deploying fully open 5G networks. It is important that we continue to build on this moment, and Open RAN is critical to achieving that goal.

One way to help spur the development of a robust, domestic, Open RAN supply chain is through Federal investment. That is why Congress created the Public Wireless

Supply Chain Innovation Fund.

To date, NTIA, the National Telecommunications and Information Administration, which administers this fund, has distributed less than $100 million of the $1.5 billion Congress provided.

It is also concerning that only in the last round of awards did NTIA finally provide grants to help with the deployment of Open RAN.

Given how long NTIA is taking to make these awards and the types of projects NTIA is choosing to fund, I am concerned we could miss the window to make the meaningful investments necessary to support widespread deployment of Open RAN and secure our networks.

The Innovation Fund is an important tool to help the U.S. cement our leadership in this technology, and we cannot afford to jeopardize our competitive edge. I hope that NTIA prioritizes Open RAN deployment projects as it continues awarding these grants.

Network security and American communications leadership are top priorities for this committee, and promoting Open RAN is key to achieving both.

Our job in Congress is to make sure that we are providing industry with the tools it needs to ensure widespread development and deployment of this technology.

I thank our witnesses for being here, and I look forward to discussing these important issues.

Thank you, Mr. Chairman. I yield back.

[The prepared statement of The Chair follows:]

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

Mr. <u>Latta.</u>   Thank you very much.   The gentle lady yields back, and the chair now recognizes the gentleman from New Jersey, the ranking member of the full committee, for 5 minutes for an opening statement.

Mr. <u>Pallone.</u>   I thank you, Chairman Latta.

Today the subcommittee continues its important oversight of our communications networks by ensuring that our country and our communications companies are active participants in developing innovative wireless networks across the world.

And as we discussed at a subcommittee hearing last week on cybersecurity, our communication networks are under constant threat as they underpin a significant part of the American economy.   Nearly every facet of American life relies on these networks, and as a result, our networks face threats that range from amateur hackers to sophisticated internet criminals, to foreign adversaries seeking to harm our Nation.

So it is imperative that our wireless networks are some of the most technically advanced and well defended networks.

Over the past several years, Open Radio Access Network, or O-RAN, has developed from a concept to wide-scale deployment.   Open and virtualized radio access technology promotes innovation in wireless networks.

It can also introduce competition amongst vendors for the individual components of wireless equipment and software, and this can help to counter the dominance of untrusted equipment makers like Huawei and support the development of new manufacturers, including those in the United States.

Now, this committee has come together on a bipartisan basis to examine supply chain security and innovations in wireless networks.   We enacted the bipartisan Secure

and Trusted Communications Networks Act, giving the FCC the authority to exclude untrusted equipment from our communications networks.

We also passed the USA Telecommunications Act. It created the Public Wireless Supply Chain Innovation Fund to help spur the development and deployment of Open RAN technology, and this program was funded with a $1.5 billion appropriation in the CHIPS and Science Act.

The National Telecommunications and Information Administration has already awarded nearly $100 million in grants from the Wireless Innovation Fund, including announcing last week, nearly $80 million in grant awards, and this funding will help build a center to test Open RAN solutions in a real-world setting in a lab dedicated to testing the performance and security of Open RAN technologies.

These investments are important as we work to help create a global Open RAN market where America and our allies have seats at the table.

To those that say that NTIA should be awarding this funding more quickly, I will just remind everyone that the agency is limited by the statute in how much it can award the first year.

I have confidence that it is administering this fund appropriately and in a way that will produce the best results, including carefully examining the applications and making the awards to the projects that will do the most to help Open RAN off the ground.

I think we can all agree that that is the best way to make sure taxpayer dollars are being used efficiently.

And the FCC is also helping to examine Open RAN. Its Communications Security, Reliability, and Interoperability Council recently issued a report outlining how to overcome the challenges in the development of Open RAN technology. The agency also

continues to study this technology and the steps needed to deploy it broadly.

Open RAN can help increase our national security and foster innovation in the wireless marketplace, but if the U.S. isn't a leader in shaping the wireless future, the nation states hostile to our country will step into the leadership void.

And this includes dominating the 5G, 6G marketplace in a way that may undermine our national security and economic prosperity, and we just can't allow that to happen. History has shown us that early adopters and developers of technology define the marketplace, drive innovation, and reap the economic benefits. And so we have to lead.

It is also critical that we come together to ensure that the rip-and-replace program is fully funded so that we can ensure our networks are secure from malicious interference.

The Secure and Trusted Communications Networks Act authorized the rip-and-replace program, but it needs an additional $3 billion to fully rid our networks of Huawei and ZTE equipment.

And I also hope smaller carriers explore whether Open RAN technology is suitable for their networks so that any network equipment deemed a security threat in the future can be removed more easily.

Congress should also make sure these carriers have the resources and technical assistance to leverage this technology.

So I look forward to the discussion, and, Mr. Chairman, yield back the balance of my time. Thank you all.

[The prepared statement of Mr. Pallone follows:]

This is an unedited transcript. The statements within may be inaccurate, incomplete, or misattributed to the speaker.

Mr. <u>Latta.</u>   Well, thank you very much.   The gentleman yields back the balance of his time, and this now concludes members' opening statements.

The chair reminds members that pursuant to the committee rules all members' opening statements will be made part of the record.

We also, once again, want to thank our witnesses for being here to testify before us today.   We greatly appreciate it.   And our witnesses will have 5 minutes to provide an opening statement which will be followed by a round of questions for members.

Mr. John Baker, senior vice president of ecosystem business development, Mavenir; Mr. Jeff Blum, executive vice president in external and government affairs, DISH; Ms. Diane Rinaldo, executive director, Open RAN Policy Coalition; and Mr. Kristian Toivo, executive director of Telecom Infra Project.

I would like to note for our witnesses that the timer light on the table will turn yellow when you have 1 minute remaining and turns red when your time has expired.

Mr. Baker, you are recognized for 5 minutes for your opening statement.

STATEMENTS OF JOHN BAKER, SENIOR VICE PRESIDENT, ECOSYSTEM BUSINESS DEVELOPMENT, MAVENIR; JEFF BLUM, EXECUTIVE VICE PRESIDENT, EXTERNAL AND GOVERNMENT AFFAIRS, DISH; DIANE RINALDO, EXECUTIVE DIRECTOR, OPEN RAN POLICY COALITION; AND KRISTIAN TOIVO, EXECUTIVE DIRECTOR, TELECOM INFRA PROJECT

STATEMENT OF JOHN BAKER

Mr. <u>Baker.</u>   Thank you.   Chairman Latta, Ranking Member Matsui, Chairwoman McMorris Rodgers, and Ranking Member Pallone, thank you for the opportunity to appear before you this morning -- or this afternoon.

My name is John Baker, and I serve as vice president for business development for Mavenir, where I lead the 5G Open RAN efforts.

Mavenir was founded 19 years ago in Texas to focus on virtualized mobile network software.   Over the years, we have been a disruptive leader, and today we are a trusted vendor in more than 250 mobile operators globally.   We are also a pioneer in O-RAN.

My testimony today will focus on three points: One, Open RAN is a proven solution that offers operators a diversified supply chain; two, an Open RAN certification process is needed to prevent vendor lock for 5G and beyond; and three, increased investment, creative solutions, close collaboration between public and private sectors can help ensure Open RAN's success.

Firstly, there is no question that Open RAN is proven, secure, and an innovative solution.   Open RAN by definition means having open and interoperable interfaces

between elements of the Radio Access Network, which is one of the main two parts of the mobile network infrastructure.

Open RAN provides a modular and flexible approach, making it easier for operators to replace individual components, and even suppliers. Open RAN brings resiliency, energy efficiency, and security to networks.

These benefits are why Open RAN is being deployed in nearly every region of the world. Globally today there are 12 commercial Open RAN deployments with 62 additional networks at various stages of deployment, testing and trialing. These numbers will continue to grow.

For our part, Mavenir has 19 Open RAN trials and deployments under way, including Bermuda, France, Germany, India, U.K., and here in the U.S., we are proud to be an Open RAN supplier for over 10,000 sites for DISH's 5G network.

We also ripped out Huawei equipment and replaced it with Open RAN for Triangle Communications in Montana as part of the FCC's Secure and Trusted Communications Networks Program.

The strong embrace of Open RAN leads me to my second point. A recognized formal certification process is needed.

Looking back in history there were decades where networks were built with proprietary, single-supplier solutions, making operators dependent on one company for their entire network. However, Open RAN disrupted the industry, bringing interoperability and a diverse supply chain.

But once again we run the risk of having single suppliers dominate our supply chain because there is no mandatory certification process to confirm when a network is indeed open, is compliant with minimum specifications from the O-RAN Alliance.

The U.S. Government should work with our allies to advance the adoption of truly open and interoperable networks and publicly support calls for global formal certification processes.

And third, further investments, creative solutions, and close collaboration between public and private sectors will help ensure Open RAN's success.

Mavenir appreciates the strong support from this committee and the entire U.S. Government to strengthen the Open RAN ecosystem.

In particular, Congress' authorization of the full funding of the Public Wireless Supply Chain Innovation Fund, a dedicated source of funding to promote Open RAN and enhance U.S. competitiveness, will undoubtedly make important contributions to Open RAN.

Today in the global marketplace, we continue to face pricing competition from China and suppliers backed by financing from the Chinese Government.   To help U.S. suppliers better compete and drive the entire Open RAN system forward, the U.S. Government should do three things: Support Open RAN radio manufacturing in the United States; two, promote price parity on semiconductor purchases, so small and midsize vendors can purchase the same chips at the same prices as large network vendors;

Unfortunately today, semiconductors for Open RAN networks are priced by individual companies purchased on volume, leading to higher costs and making it harder for smaller companies to compete;

And three, make investments to achieve scale and promote test centers that focus on certification and product validation.

It will take creative thinking and close coordination between government and

private sector, such as in the area of access to affordable working capital to better enable U.S. suppliers to compete on the world stage.

Lastly, Mavenir is replacing untrusted equipment in the RAN and the Core for part of the Secure Trusted Communications Network Program, and we urge Congress to fully fund the program.

Thank you for the opportunity to testify, and I look forward to your questions.

[The prepared statement of Mr. Baker follows:]

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

Mr. <u>Latta.</u>   Well, again, thank you very much for your testimony today.

Mr. Blum, you are recognized for 5 minutes for your opening statement.

STATEMENT OF JEFF BLUM

Mr. <u>Blum.</u>   Chairman Latta, Ranking Member Matsui, and members of the committee, thank you for inviting me to testify at this hearing.   My name is Jeff Blum.   I am the executive vice president of government affairs at EchoStar Corporation, the parent company of DISH Wireless.

While DISH has testified before this committee many times as a pay-TV provider, today marks our first appearance before Congress as a wireless carrier.   I am proud to say that DISH is the first company in the world to deploy a Cloud-native, Open RAN, 5G wireless network that today covers more than 246 million Americans.

DISH, founded by Charlie and Candy Ergen, got its start in 1980 as a small business outside Denver, selling satellite TV systems to rural customers.

As a satellite TV company, we successfully disrupted the pay-TV market by using innovative technologies.   Now we are working to also disrupt the wireless industry.

We began our wireless journey in 2008 with our first purchase of mobile wireless spectrum.   Since then, we have spent over $30 billion on spectrum and participated in every FCC auction.

With enough spectrum to get service off the ground and to the surprise of those who doubted us, we started rapidly building out our network in 2020.

Today consumers across the U.S. can sign up for one of the competitively priced

wireless plans offered by DISH's Boost brands. We are also excited for O-RAN networks like ours to more effectively meet the growing demand for private 5G.

From the start, we were confronted with questions around how we would do it. Afterall, wireless networks are very expensive and complex to deploy, and the U.S. market is saturated with large incumbents.

We knew if we were to be successful, we couldn't stick to the same formula and rely on legacy architecture. So DISH executives and engineers hit the road to study what equipment vendors were developing and what newer networks looked like across the globe.

As we observed Open RAN principles in action, the answer crystallized. O-RAN could enable us to build our wireless network from the ground up and leapfrog legacy deployments.

It would be more resilient, secure, upgradable, cost-efficient, software-based, and faster to deploy. It would position us to provide a better, more innovative wireless service while helping advance U.S. wireless leadership.

Most of the world's wireless networks are reliant on end-to-end closed technology provided by one vendor, but we did not want to be locked into a single company for the design, build, and operation of our network.

We saw that O-RAN's disaggregation, interoperability, and virtualization of network components would enable competition between technology providers and allow us to choose from a wider range of best-in-class vendors, many of them U.S. companies, to construct a modern, software-based network. And we did it.

Working with over 80 vendors, we designed and built our O-RAN network despite starting the build-out during a global pandemic. At the start of 2020, we did not have a

single operational 5G cell site.

Today we have over 20,000, covering more than 73 percent of the U.S. population. Our O-RAN network has been certified by the major cellular device makers, including Apple and Samsung, validating its performance capabilities, and we are eager to share our experience to help others realize the benefits of O-RAN.

Thanks to the legislation that this committee championed, we were thrilled to receive a $50 million grant last week from NTIA to establish an O-RAN testing center at our Cheyenne facility.

The O-RAN Center for Integration and Deployment, or ORCID, will be a living laboratory that enables trusted vendors to test their hardware and software innovations against DISH's commercial-grade network and tap into the expertise of DISH, and its partners, like Mavenir. We believe ORCID will be an important part of supporting the O-RAN ecosystem.

In closing I would like to note a few things as we look ahead. First, U.S. wireless leadership would benefit greatly if the rural carriers, who must remove Chinese equipment under the rip-and-replace program, deploy Open RAN.

Second, a standard split should be avoided. When new technologies proliferate, there can be a splintering around standards and how best to incorporate those standards into existing or new systems. This would harm Open RAN since it would make integration harder, limiting supplier diversity.

Lastly, we anticipate that the Cloud-native nature of O-RAN will fuel AI advancements that, in turn, will improve O-RAN networks.

Thank you for the opportunity to testify about DISH's Open RAN deployment. I look forward to your questions.

[The prepared statement of Mr. Blum follows:]

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

Mr. <u>Latta.</u>   Pardon me.   And thank you very much very for your testimony today, and Ms. Rinaldo, you are recognized for 5 minutes for your statement.

STATEMENT OF DIANE RINALDO

Ms. <u>Rinaldo.</u>   Thank you so much.   Chairman Latta, Ranking Member Matsui, and the members of the committee, my name is Diane Rinaldo, and I am the executive director of the Open RAN Policy Coalition.   And on behalf of the Coalition, I extend our gratitude for this opportunity to discuss the transformational role of Open RAN and interoperable solutions in the Radio Access Network, particularly as we navigate the evolution of 5G technology and as we prepare for 6G and beyond.

Founded in 2020, the Open RAN Policy Coalition promotes policies to drive the adoption of open and interoperable solutions.   This initiative transcends technological advancements.   It represents a strategic shift towards fostering innovation, stimulating competition, and broadening the supply chain for next-generation wireless technologies, including 5G.

Our coalition represents a diverse group of ICT companies unified under a common goal -- dismantling technological and market barriers to cultivate a competitive, secure, and resilient marketplace.

The deployment of advanced mobile networks like 5G is at a pivotal moment, not only for technology policy but for economic security and global connectivity.   Open RAN is at the heart of this transformation, influencing how we approach economic and security challenges.

A robust and diverse supply chain is critical, and international cooperation on wireless technology is now more vital than ever.

Since I first addressed this committee almost 3 years ago, we have made tremendous progress with more than 100 global Open RAN deployments, including the world's largest deployment -- DISH Wireless -- right here in the United States.

The Open RAN story is far from complete, though, and there is more work to be done. The Wireless Innovation Fund of the CHIPS and Science Act, spearheaded by leaders of this committee, was a landmark achievement, introducing grant programs to catalyze Open RAN initiatives.

However, the allocation and deployment of these funds have not met the pace of innovation, with only a marginal percentage of the allocated budget being utilized.

Of the $1.5 billion allocated, only 6 percent has been distributed -- 4 percent to business and only one-tenth of 1 percent to small business. To truly drive innovation it is essential that these funds are fully deployed within the next 2 years.

The undeniable truth is that we face global challenges to maintaining our competitive edge. China's Belt and Road Initiative and Digital Silk Road, with more than 150 countries participating, has made networking deployment a priority.

The CCP and their national champions are competing with the full, financial backing of China and with strategic intent of vendor lock-in.

While Open RAN reduces costs in hardware and software and creates the possibility to break vendor lock-in, these heavy foreign investments tip the scales more than the cost savings that Open RAN produces.

My experience across various roles, including the House Intelligence Committee, and as the head of NTIA, have highlighted the persistent issue of financial constraints of

developing nations, making them susceptible to predatory moves of malign actors.

Simplifying and expediting the process for our companies to compete effectively is necessary to shorten that funding gap.

To improve the financial footing of global telecom deals and to establish the U.S. as a major counterbalance to the CCP, the Coalition is seeking for the Export-Import Bank, or Exim, and the Development Finance Corp to have to more flexibility in financing wireless telecommunication projects, especially those promoting strategic security interests, including Open RAN.

Our proposal is simple. If a trusted supplier is competing for a global project against, or proposing to, rip-and-replace a company on the FCC's covered Entity List, Exim and the DFC would have the ability to waive certain statutory, financial-risk restrictions.

This narrowly tailored update targets advanced wireless telecommunication infrastructure projects, promoting U.S. strategic security interests, including Open RAN wireless networks.

It would provide a market-based mechanism to help level the playing field and allow trusted suppliers to compete, win bids, and advance U.S. interests. This is a necessary first step in coordinating an allied effort to combat these marketing distorting subsidies.

The coalition's global engagement expands more than 80 countries, promoting open and interoperable telecommunications standards. This presence not only enhances connectivity and economic growth but also strengthens international relations.

The Coalition's efforts in bridging the digital divide in underserved regions exemplify our commitment to global leadership and to technological advancement.

We work with governments around the world at every stage of adoption.

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Regardless of the starting point, our work will drive governments upward on the adoption curve, catalyzing private sector activity.

The journey of the Open RAN movement is a testament to innovation and opportunity. To maintain momentum, it is imperative that funds allocated under the Wireless Innovation Act be fully and promptly utilized.

We must also adopt a holistic approach to counter the global market distortions and ensure competitive parity for U.S. and allied vendors.

The Coalition seeks not to reinvent the wheel but to ease the path forward, ensuring the continued evolution and success of the telecommunications industry.

Sorry I went over, but I appreciate the opportunity.

[The prepared statement of Ms. Rinaldo follows:]

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

Mr. <u>Latta.</u>   Well, thank you very much for your testimony, and, Mr. Toivo, you are recognized for 5 minutes for your opening statement.

STATEMENT OF KRISTIAN TOIVO

Mr. <u>Toivo.</u>   Chairman Latta, Ranking Member Matsui, Chairwoman McMorris Rodgers, Ranking Member Pallone, and all members, thank you for giving me the opportunity to testify on the promise of Open RAN.

My name is Kristian Toivo.   I am the executive director or Telecom Infra Project, or TIP.   TIP is a U.S.-based nonprofit organization with more than 600 members from across the globe.

We convene industry to accelerate development and deployment of open and disaggregated solutions such as O-RAN.   Our activities are industry-led and membership-driven.

Since 2016, TIP has convened stakeholders to drive the transformation of the equipment supply chain.   TIP is a neutral facilitator, enabling stakeholders to collaborate on product roadmaps, testing, and sharing of knowledge to reduce duplication.

Our testing activities are lab agnostic, managed within TIP's project groups, and governed by our test and validation committee and the board.

Based on decades of experience in this industry, I see the establishment of the Wireless Innovation Fund as a profound investment that will pay dividends for generations to come.

I also want to thank Congress for explicitly recognizing TIP's leadership in the

statute that created that the fund.

We are at a critical inflection point for Open RAN.   Several carriers have successfully deployed or committed to start deploying Open RAN in the U.S., Europe, and elsewhere.

Still, several market factors continue to hinder acceleration and progress.   These include pressure on revenues and investments from increased competition and demand; significant efforts that are needed to integrate and test individual RAN components into an Open RAN system; a heightened focus on security and resilience with increased operator costs and limits risk tolerance; concentrated equipment supply chains that hinder new vendors from achieving competitive prices when volumes are still low.

For Open RAN to succeed at scale, the full ecosystem must come together to address these challenges.

In the coming months, we can fundamentally change the global market for Open RAN.   To explain why this is the case, I want to highlight the crucial distinction between two key concepts in Open RAN.

First, component-level interoperability, which is the primary focus of the Open RAN Alliance technical specifications, for instance, ensuring that the antenna at the top of the cell tower interoperates flawlessly with the base-station computing functions on the ground.

Second, system-level functionality and performance, which is TIP's primary focus. This ensures that the interoperable components work together as a carrier-grade system.

Here is the basic distinction.   Just as consumers purchase whole roadworthy automobiles, typical wireless carriers, be it AT&T and Verizon or global other players, they purchase whole RAN systems.

Consumers wouldn't purchase separately individual components for a car, such as the engine, steering wheel, and tires, and likewise for carriers purchasing RAN.

The way Ford and GM built their systems, that is, the cars that they sell to consumers, is very similar to the pre-Open RAN model for incumbent vendors that build and sell their RAN systems to carriers -- proprietary systems, whose inner workings are largely close to outside vendors.

Open RAN breaks this approach, but thereby requires testing of individual components for interoperability and validating the whole system for its functionality and performance.

In short, O-RAN Alliance specifications ensure that the individual parts are interoperable, while TIP system certification ensures that the whole system performs as it is supposed to, that is, the car is safe and stays on the road.

The industry has largely achieved component interoperability, but there is more work to be done to ensure system functionality and confidence in its performance. These are the breakthroughs that are needed, and relatively modest public funding can make this happen.

For Open RAN deployment, carriers must work with many vendors that provide these different components -- hardware and software. Even if individual components are interoperable, it can be difficult for carriers to integrate all these into a deployable system.

System certification enables carriers to leverage integrated and tested Open RAN systems in an efficient manner.

This challenge does not exist in traditional RAN systems where incumbent vendors design, build, test, integrate, and so forth, their own solutions for all their customers.

For Open RAN to flourish, we must establish a trusted, neutral, nonprofit global system certification regime. Industry has repeatedly underscored the need for this, and many companies have urged NTIA to use the Wireless Innovation Fund to support an independent entity to perform this work, some citing the Wi-Fi Alliance as a useful model.

TIP proposes to leverage its experience to develop this capability for the Open RAN industry. It is hard for individual carriers or vendors to perform this function because companies are unlikely to seek certified solutions from their competitors.

Thus, a neutral nonprofit entity with global reach is needed to work with multiple lab partners throughout the world. This is the critical missing link to accelerate Open RAN market's readiness. System certification creates Open RAN solutions ready for carriers' acceptance testing.

A window of opportunity remains within the remaining 5G build cycle, including in private networks, but the industry and government must act together now.

Given the long cycles of RAN deployment with trials and smaller deployments preceding large-scale rollouts, the need for establishing Open RAN certification is now.

The Wireless Innovation Fund is poised to seize this moment. As the industry continues to mature, public investment is necessary to fully realize the system certification model and to realize the promise of U.S. and allied suppliers.

I look forward to your questions to discuss this further and apologies for going over time.

[The prepared statement of Mr. Toivo follows:]

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

Mr. Latta.   Well, thank you very much for your testimony, and this concludes our witness testimony and their opening statements.

And before I recognize myself for 5 minutes for opening questions, I will just remind members we will be having votes again probably at 4:30.   So I am going to do my best to stay right at 5 minutes, and if we can all do that, I would really appreciate it.

Mr. Blum, DISH deployed the Nation's first open 5G network.   What challenges and lessons has DISH learned from that experience?

Mr. Blum.   Really it was system integration.   No one had ever broken apart the network before and put it all back together with multiple vendors.   So we had JMA providing the antennae.   We had Fujitsu providing the radios.   We had Mavenir providing the DUs, Dell providing the servers, Nokia, the core, Amazon, the Cloud.

So we ended up becoming the system integrators, and that is a challenge, as carriers were looking to deploy Open RAN.

The good news, Mr. Chairman, is, we have done it, and our vendors have became much more wiser and more adept at taking all of the learnings and putting together a network that now is at scale and has the performance capabilities of the incumbent.

So it is overcoming those challenges, and that is why I think the legislation that this committee helped pass on the grant program is so important.

The lab that we are going to be setting up in Cheyenne will help vendors across the world -- trusted vendors -- come to our lab and test their hardware and software innovations against what we have deployed.

Hopefully, from that experience, they will be able to then go to other carriers here in the United States and the rest of the world to sell their products.

This is an unedited transcript. The statements within may be inaccurate, incomplete, or misattributed to the speaker.

Mr. Latta.   Well, thank you very much.

Ms. Rinaldo, a key advantage of the Open RAN is its interoperability.   Operators will be able to mix and match equipment from different vendors and their networks, but for Open RAN to be interoperable, there must be agreement on standards and specifications.   Otherwise, equipment from different vendors won't work together.

How is the development of uniform standards for Open RAN progressing?

Ms. Rinaldo.   Thank you for the question, Mr. Chair.   So the Open RAN Alliance is working through standards.   They have been doing this for several years now, and it will continue in different iterations.

They are working through cybersecurity standards.   They are working through the interoperability standards as well.

I know my other witnesses are probably a little bit more in tune with what is happening at the Alliance as they do participation there.

We do work with the Open RAN Alliance, we work with TIP as well, but more in a high-level, how can we help each other out, not in a -- more of a day-to-day work, but it is incredibly important to get the standards right.

As been discussed at this -- earlier in testimony, it is important that we come to an agreement on a single standard.   It makes it a lot easier to manufacture equipment.   It makes it less expensive to manufacture equipment.   It makes it a lot easier to help roll out and deploy Open RAN.

Mr. Latta.   Thank you.

Mr. Toivo, how can we ensure that, moving forward, all vendors are using the baseline standards for Open RAN so that they are producing truly interoperable equipment?

Mr. Toivo. So I think first piece of the work and the puzzle is to really participate and comply with the O-RAN Alliance work that Ms. Rinaldo was referring to, and I think that is kind of a default. I mean, a vendor who is not complying cannot really be seen as interoperable.

Secondly, it comes back to some of the topics that were brought up both in my testimony and my colleagues'. We need consistent, structured, interoperability testing which, to some extent, is already built into the O-RAN Alliance work, but also we need system testing and system certification. That will confirm that the components not just on their own, but the system overall, works as intended and is complying.

I think the world of telecommunications is quite used to operate in a standards fashion and used to global standards. The actual detail is then to sort out when you bring the two pieces together in the interoperability testing.

If there is anything that is not matching standards, it will be sorted out at that piece of the work. But then when the whole system comes together, that will be the proof point that it can be certified as a compliance system and thus enable also further swap-out of individual components if needed.

Mr. Latta. Thank you.

Mr. Baker, in my last 44 seconds, have small providers use rip-and-replace as an opportunity to explore Open RAN?

Mr. Baker. Yeah. So as I spoke in my testimony, Triangle Communications in Montana has actually got a full Open RAN network, fully deployed and running as of today and proves that small vendors, even with their limited technical capability, can deploy Open RAN today.

Mr. Latta. Well, thank you. And I am going to ask you real quick, yes or no

question, with my last 17 seconds left. Is the United States winning the race in 5G?

Mr. Baker. Yes. There is great opportunity in 5G. 5G stand-alone is a fantastic opportunity for the U.S.

Mr. Latta. Thank you.

Just a quick yes or no. Mr. Blum?

Mr. Blum. Yes.

Mr. Latta. Thank you.

Ms. Rinaldo?

Ms. Rinaldo. Yes.

Mr. Toivo. Yes.

Mr. Latta. Well, thank you very much. My time has expired, and at this time, I will recognize the ranking member of the subcommittee for 5 minutes for questions.

Ms. Matsui. Thank you very much, Mr. Chairman.

Testing and evaluation are effective tools to provide new entrants with proof concept and for operators to ensure they are receiving equipment that meets their specifications, but we also need field testing to ensure compatibility and performance.

Mr. Blum, how will DISH be leveraging its network to support vendor testing at ORCID, and what incentive does DISH have to increase vendor diversity in Open RAN?

Mr. Blum. Our incentive in growing the ecosystem is, we could have better vendors at a lower price, offering better quality service, and that is what is driving our grant proposal in ORCID.

One of the things that we have learned in deploying our Open RAN system is, things could work in the lab. Oh, it is great in the lab. But when it actually gets to the field, there is a lot of problems.

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So what our lab will do, in Cheyenne, is, of course, have lab testing, but it will have a field component. So a radio vendor will be able to come in, test their radio, iron out the bugs in the lab, and then we will actually put it on a tower and test it against our commercial-grade network that has been certified by major cell phone carriers.

So then that small vendor could take the results and go to hopefully AT&T, Vodafone, other vendors interested in deploying Open RAN and offer their product and service and have that sort of stamp of approval.

So I agree with you, field testing is a critical component.

Ms. Matsui. Right. Thank you.

For Open RAN to realize its full potential of true interoperability, standards must be consensus-based and broadly accepted. Proprietary interests or unnecessarily complicated specifications risk a split in the market that can hamstring further adoption.

Mr. Blum, what are the qualities or standards that you believe best promote interoperability and competition?

Mr. Blum. Fortunately, the Open RAN Alliance, which our network is compatible with, has a standard called 7.2. It is sort of technical, but it allows that interoperability. So our network is built to this standard, and other operators are deploying this 7.2 standard.

We are concerned that some vendors, including the Chinese, are promoting a different type of standard that is not compatible with 7.2.

What we don't want, as I said in my testimony, is a splintering. We don't want what happened in the 1980s with Betamax and VHS. They both worked, but they weren't compatible.

We want one compatible set of standards that carriers here in the United States

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and the rest of the world can rely upon and deploy, so great companies like Mavenir don't need to make two different versions of the software.

Ms. Matsui.   Right.   Thank you.

Just as the United States is committed to removing Huawei gear from our networks, we have been active in encouraging our allies to do the same.

However, in developing nations, where telecom networks are being deployed, the technology used to deploy them has long-standing geopolitical implications.

Ms. Rinaldo, can you describe the challenges we face in encouraging other nations to deploy interoperable technology, and what are the benefits when they do?

Ms. Rinaldo.   No, absolutely.   I would say when I was at NTIA at the roll-up to 5G and would have to talk to my counterparts around the world and ask why they chose one vendor over the other, it was always cost.

And we would just come back to them and say security, right, and it didn't move the needle.

The thing about Open RAN and why I believe that it has been so successful is that we give people something to run to as opposed to run away from.

So, yes, we still face challenges, we still face the full financial backing of China and their Belt and Road as they compete against U.S. and allied manufacturers, but we have been able to close the cost gap with Open RAN.

We have seen costs for CapEx as low as 40 percent less than traditional and OpEx as low as 30 percent.   So we have some initiatives that we are working on, as I mentioned in my testimony, Exim and DFC.

Telecom, as you all know, is an incredibly debt-heavy industry.   How can we close the gap to be stronger and to compete better?   So we are facing these challenges,

but we are in a stronger position every day.

Ms. Matsui.   Okay.   Thank you.

It is clear that while individual components with RAN may be interoperable, that itself does not guarantee systemwide interoperability.

Mr. Baker, why is this the case, and how does system interoperability certification support the Open RAN market?

Mr. Baker.   Yes.   Good question.   So, you know, without interoperability, you don't have Open RAN, and that implies that you need two vendors essentially to work side by side and cooperate, as with the DISH network, to actually produce interoperability.

The fact that you have interoperability within those elements to a defined specification allows you then to address one piece of that marketplace so you can actually produce one element.   You don't have to produce the whole network now as a vendor, and small vendors can then participate and compete alongside all the other vendors in the Open RAN marketplace.

Ms. Matsui.   Okay.   Thank you very much, and I yield the balance of my time.

Mr. Latta.   Thank you very much.   The gentle lady's time has expired and yields back.

The chair now recognizes the gentle lady from Washington, the chair of the full committee, for 5 minutes for questions.

The Chair.   Ms. Rinaldo, Congress created the Public Wireless Supply Chain Innovation Fund to support the development and deployment of O-RAN.

NTIA is charged with administering this fund, and to date, NTIA has distributed approximately $98 million of the $1.5 billion Congress provided.

How would you assess NTIA's administration of the Innovation Fund and the projects that it has chosen to support?

Ms. <u>Rinaldo.</u>   So I would say we have a great working relationship, and they have quite the huge feat ahead of them with the Wireless Innovation Fund as well as distributing the $50 billion for BEAD.

But if we want this to be impactful, the money needs to go out in the next couple of years.   When we started this conversation 3 years ago, we were talking about how it is a 5G conversation and not a 6G conversation.

Well, now I am saying it is a 5G and 6G and not 7G.   If we let this money go for the next 10 years, this is a 7G conversation, and we don't want to be in that position.

The <u>Chair.</u>   Thank you.   As a follow-up, has NTIA acted in an open and transparent manner?

Ms. <u>Rinaldo.</u>   Yes.

The <u>Chair.</u>   Thank you.

Mr. Toivo, standards are set in multi stakeholder forums featuring participants from around the world.   How do you ensure that companies controlled by the Chinese Communist Party do not influence the standards process in that in their favor?

Mr. <u>Toivo.</u>   Thank you.   Yeah, that is a good question.   And I think the world is -- and the telecoms is quite used to running complex standards processes, and it is essential that we have global standards because that creates the potential for economies of scale, not just for equipment vendors but also for those vendors that develop the terminals and user equipment that are needed to run on these networks.

I don't think there is any fundamental trick with which you can influence as a single company because this is a consensus-driven process.

What is very important is that organizations and companies, large and small, from the trusted allies' side, are active, do the necessary investment of staff and competence, and participate in this.

And then by that, we will ensure that we have a standards process that is yielding results with which we can build trusted open networks.   Thank you.

The Chair.   Thank you.

Ms. Rinaldo, do you have any thoughts?

Ms. Rinaldo.   No I think he --

The Chair.   Okay.

Ms. Rinaldo.   Sorry.   He summed it up nicely.   Thank you.

The Chair.   Okay.   Ms. Rinaldo, restoring spectrum auction authority is one of this committee's top priorities.   Can you discuss the connection between spectrum auction authority and O-RAN?

Ms. Rinaldo.   So you will be pleased to hear that I am a wireless association that doesn't focus solely on spectrum, but I definitely have an opinion on this.

If you want more Open RAN, you need more spectrum.   My members, they need consistency, they need an understanding of how their business is going to roll out the next couple of years, and coming to a standstill hurts us all and hurts future innovation.

The Chair.   Thank you.

Carriers are already deploying 5G, and work has started on 6G.   You were talking about that.   How will the transition from 5G to 6G affect O-RAN?

Ms. Rinaldo.   I think it is going to be incredibly transformational.   I have -- I have top tiers from the United States, I have Vodafone, I have Telefonica, Deutsche Telekom, and they are all either testing or deploying Open RAN.

I think that Open RAN is going to provide a lot of exciting new things for the industry, and they are seeing this.

I think that DISH leading the way has given a lot of peace of mind. So I think that you will see big things to come for 6G, for the larger companies, and then as we roll out 5G here in the U.S. for smaller, rural areas, as well as global carriers, you are going to start seeing things in the next several years.

The Chair. Thank you.

Mr. Baker, would you share your perspective?

Mr. Baker. Yes. You know, Open RAN is actually foundational to the future and -- you know, it is foundational not only to enhancing the profitability of 5G, where, you know, operators are struggling today, but also the future of 6G and other G's in also relying on web-based technologies such as virtualization, which will bring the web and the mobile radio networks together and provide the services that are required in the future.

The Chair. Thank you. Well, thank you all for being here.

Thank you, Mr. Chairman. I yield back.

Mr. Latta. Thank you very much. The gentle lady yields back the balance of her time, and the chair now recognizes the gentleman from New Jersey, the ranking member of the full committee, for 5 minutes for questions.

Mr. Pallone. Thank you, Mr. Chairman.

In my opening remarks, I mentioned that I have confidence in NTIA's stewardship of the Wireless Innovation Fund, and while I believe we should all prefer that NTIA not be limited in the amount it could award during this first year, I think we will see things really accelerate in the months ahead.

And so while NTIA has still more funding to award from the original appropriation,

I wonder if there is more Congress can do now to further innovation and competition in the marketplace.

So my first question is just a yes or no each for panelist, whether you think Congress should consider appropriating additional funding for the Wireless Innovation Fund. Just yes or no to start with.

Mr. Baker. Yes.

Mr. Blum. Yes.

Ms. Rinaldo. Yes.

Mr. Toivo. Yes.

Mr. Pallone. Thank you.

Now, last week, DISH received a significant grant from the Wireless Innovation Fund to establish an Open RAN testing center which will be an operation in collaboration with -- Mavenir I guess -- Mavenir systems.

So, Mr. Blum and Mr. Baker, could you both talk about how this funding and your center will support U.S. leadership in Open RAN both here and abroad, if you would?

Mr. Blum. We think the lab will be a showcase for the rest of the world and for other carriers to come and visit. The focus is to allow the Open RAN vendor community to take all of the inventions, all the innovations that are happening, and help them commercialize their hardware or software.

And the best way to do that is to be able to come into the lab, bring their hardware or software, and test it against what we have deployed at scale, and if they pass, to be able to take those results and collaborate with other vendors and other carriers to sell their products.

That will help U.S. wireless leadership and help spur further developments of

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Open RAN throughout the world.

Mr. <u>Pallone.</u>   Thank you.

Mr. Baker?

Mr. <u>Baker.</u>   Yes.   So to date, you know, under the previous legacy systems, it has been almost impossible for new companies to actually try and sell a product or integrate a product into an existing carrier's network.

What DISH is providing is the ability for small companies to actually do that and bring their product concepts, their solutions, and then integrate them with Mavenir software or other Mavenir components and demonstrate, in a real-life environment of true mobiles running around a network, the quality of service and effectively the benefit to mobile operators of their designs and technology.

Mr. <u>Pallone.</u>   Okay.   Thanks.   One more question.

For Open RAN to be successful, it must be embraced by new wireless entrants who need to build a new network from the ground up -- and that is of course DISH which is doing that -- but it also has to be embraced by existing carriers who want to transition, if you will, transition their existing networks to this technology.

So I appreciate AT&T's recent announcement with Ericsson to accelerate the deployment of Open RAN technology throughout its network and look forward to additional details about that transition.

But let me go to Mr. Toivo and Ms. Rinaldo.   Why have existing carriers been more cautious in embracing Open RAN technology, and what will it take for them to feel confident deploying this technology and working with new vendors in the wireless market?

Mr. <u>Toivo.</u>   Shall I start?   Congressman, I think it is a very valid question.   And I

think we talk in the industry about greenfield for new networks and brownfield for networks which already has existing equipment, and I think they, existing carriers, they have felt the challenge in terms of ensuring how you can, in an easy way, introduce a new technology in the midst of already an operating and running network.

And there is not just the requirement on the technology and its kind of functionality and performance, it is also how it is easy to operate and manage in a complex environment, and that has been a topic that has taken some time.

There is still work to be done in what we call the OSS, operation support system space, service management operation, which is still also under development in terms of O-RAN Alliance specifications, and the existing large carriers are already actively driving those solutions forward.

So I think it is simply just a more challenging task. Now, to motivate them to do that faster, we believe system certification that we talked about in our testimony is one key component, that they can feel confident that those new O-RAN solutions have been validated in such a way that they don't need to do all that testing themselves.

[3:14 p.m.]

Mr. Pallone.   I want to let Ms. Rinaldo say -- respond, too, because we are going to run out of time.   Thank you.

Ms. Rinaldo.   So I would say that they have come a long way.   I think you need to look at DISH.   One of their largest vendors is Samsung, and so that has to turn heads. Samsung was an incumbent, and now they are one of DISH's largest Open RAN vendors.

We at the coalition work with carriers here in the U.S. globally, understanding that vendors are going to skate to where the puck is.   So how can we incentivize carriers to build Open RAN?   And then the business will follow.

Mr. Pallone.   All right.   Thanks a lot.

Thank you, Mr. Chairman.

Mr. Latta.   Thank you.

The gentleman yields back.

The chair now recognizes the gentleman from Michigan's Fifth District for 5 minutes of questions.

Mr. Walberg.   Thank you, Mr. Chairman.

And thank you to the witnesses, as well, for being here.

This Congress, my 5G Caucus co-chairs and I reintroduced the Promoting U.S. Wireless Leadership Act which was forwarded by a unanimous vote by this committee last March.   We cannot cede our international leadership on wireless technologies.

I was glad to hear each of your answers, yes, that we are leading.   I hope that

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isn't telling us what we want to hear, but I hope it is reality. We need to keep at it.

Ms. Rinaldo, how can we incentivize more trusted companies to participate in the international standards forums?

Ms. Rinaldo. We appreciate your leadership on the legislation. It is something the Coalition is very supportive of and we discuss in our comments to NTIA.

The one thing we have encouraged NTIA to do with the public wireless funding is to help support business to send people to standards bodies. That is how we are going to kick-start efforts on O-RAN for 3GPP. We need to go in with strength force.

Our member companies are doing incredible innovative things. We are leading on R&D, but we need to go into these standards bodies in order to set our mark and make a difference as we move into 6G.

Mr. Walberg. Because it is that innovation, the push toward that --

Ms. Rinaldo. Absolutely.

Mr. Walberg. -- and the incentives that encourage that are important. I think there is that fine line of government getting in the way as well. We can't do that.

Ms. Rinaldo and Mr. Toivo, for Open RAN to be competitive, it needs to be adopted globally. DISH has deployed here. Other carriers are transitioning to Open RAN. I understand that there are deployments in countries like Japan and Germany, to name a few.

My question is: How are conversations going with our allies to encourage more widespread adoption of Open RAN?

Ms. Rinaldo. Things are going well. We have over 100 deployments globally, and that is in a couple of years' time.

Here in the United States, a lot of our large tier ones have already had their

contracts in place for 5G. So the telecom curve is a little cyclical. So we are focused mostly globally these days.

We have regular conversations, work with governments however they would like. We are -- can be a little bit more hands-on or otherwise just provide briefs on what the benefits of Open RAN. And as I have mentioned, it really does resonate with global leaders.

It also is helpful for nascent manufacturing sectors, service sectors. The barrier for entry in telecom has been so high for so long. Open RAN really does open up a new ecosystem, and so that gets folks excited.

Mr. Walberg. Mr. Toivo?

Mr. Toivo. Beyond what Ms. Rinaldo said, I think there are two ways of dealing with this. One is, first of all, sharing of experiences and results. In TIP, we have a process where we bring operators together. And particularly for Open RAN, we have an active cooperation between two large European carriers and the U.S.-incumbent carrier, working on sharing experiences and actually trying to define the system-level certification that would benefit everybody.

The second thing is where U.S. Government is actually quite active is to work on not just what the NTIA, what its innovation fund is doing, but also through the USDA and USAID, TIP is working together with both organizations in Southeast Asia in terms of creating, let's say, the platform and the understanding and knowledge that is needed for those market actors to take qualified, knowledgeable decisions that hopefully will also then support Open RAN as their choice.

Mr. Walberg. Thank you.

Mr. Toivo, what more can the U.S. be doing to ensure developing nations choose

trusted equipment built by the U.S. and democratic allies?

Mr. Toivo.   So I think the key to get Open RAN to be even broad, more broadly, now engaged uninterrupted is to create scale.   And that means creating a market and ensuring that the standards, the choices stay consistent, that new vendors have a chance to achieve that scale that takes down price.   Ms. Rinaldo talked about the pricing being essential.

And I think there is, already mentioned by the other witnesses, various way of facilitating export and commercial competitiveness in light of the emerging ecosystem on Open RAN, which is still lacking that scale factor.

Mr. Walberg.   Okay.   Well, thank you.

And, Mr. Chairman, I yield back.

Mr. Latta.   Thank you.

The gentleman yields back.

And the chair now recognizes, let's see, the gentleman from Florida's Ninth District for 5 minutes for questions.

Mr. Soto.   Thank you, Chairman.

As we have all seen, cell phones have become an integral way of American life and to a certain extent, maybe too much.   Right?   And thus 5G has arrived.   We have seen innovation speed up, improved experiences for streaming, downloading, AI, for gaming. And it has been really a renaissance.

But many Americans would be surprised to know that only three companies dominate the 5G equipment market.   One of them, Huawei, we have literally have a policy of rip and replace to remove them from our network because of spying on us.

And so, we have heard a lot about a solution here today for Open Wireless Radio

Access Networks, O-RAN, because it is interoperable.   And the CHIPS Act was a big step. We saw the Public Wireless Innovation Fund, $1.5 billion, to help develop O-RAN.   And it would be great.

Mr. Baker, can you paint a picture to us of what it means for O-RAN to transfer networks from hardware to software center?   What does that really mean?   We got a lot of discussion on the analysis.   I know you alluded to it.

Mr. Baker.   Yes, certainly.   I think, first of all, you know, everybody should recognize the great achievement from Open RAN, what it has achieved today.   You know, 3 years ago, three vendors basically controlled the marketplace.   As of today, there are now seven-plus new vendors in the marketplace, able to compete with the three incumbents.

And, you know, Mavenir 3 years ago couldn't sell a radio, a piece of radio equipment into an existing mobile carrier.   Today we have over 19.   So, you know, Open RAN has been astounding -- you know, astounding -- outstanding success in that sense.

And then taking that further, it is actually employing virtualized technology actually in the radio network with this aggregated hardware and software.   So in a sense, these have become software networks that can be changed dynamically, on the fly, continuously upgraded with new features and functionality so the operators don't have to work, wait for the, you know, 3-year development cycle where everybody gets everything the same.

And we have seen with DISH that you can fix challenges overnight with software upgrades, rather than waiting for pieces of hardware to be turned and those problems fixed.

Mr. Soto. Now you mentioned seven new companies. A couple of those are U.S. companies now?

Mr. Baker. Yeah, so you know, you have Mavenir. You have Power Wireless. So we are really out there now, you know, as system, end-to-end system vendors, supplying networks into the world's telecommunication market.

Mr. Soto. And would you say the CHIPS Act and the Public Wireless Innovation Fund help contribute to the rise again of U.S. equipment and software telecom --

Mr. Baker. That has certainly very much has contributed to the awareness. Now, you know, the one thing I say, Mavenir, I think the U.S. Government and what the U.S. Government has been doing has been some of our best salespeople around the world now in promoting Open RAN.

And I have personally been on workshops with CLDP, NTIA, promoting Open RAN around the world. And, you know, if this continues, I think, you know, Open RAN will, you know, get significant interest in many, many countries around the world and make it a global opportunity.

Mr. Soto. And you mentioned fully funding the Public Wireless Innovation Fund in your remarks. What does fully funding mean? What do you think it is going to take?

Mr. Baker. Yeah, so at the moment the rip and replace has only funded 40 percent of, you know, of the money. So, you know, people like Mavenir that have participated in that and, you know, we are still outstanding in the completion of that activity to get the Chinese equipment out of our networks. So there is still Chinese equipment in the networks, waiting for this funding to take place.

Mr. Soto. And let's go back to the hardware. So if additional funding was allocated to the program for the future, how would that benefit U.S.-based vendors,

including U.S.-based hardware manufacturers in competing in the wire place, marketplace both at home and abroad?

Mr. Baker. Yes, so certainly, you know, now many vendors have the opportunity to participate in the ecosystem. As of today, I think there is over 120 companies now participating in the Open RAN ecosystem globally of which 50-plus of those companies are out of the United States.

So, you know, funding these opportunities, funding these integration tasks will actually help Open RAN actually become credible around the world.

Mr. Soto. Thank you so much.

Mr. Toivo, University of Central Florida is working quite a bit on modeling and testing and generative AI and digital twins. How do you think technologies like this are going to help with modeling and testing for O-RAN?

Mr. Toivo. Thank you. That is a very good question.

First of all, I think AI will be extensively used in automating and optimizing testing in general, which applies whether it is Open RAN or any other technology for telecommunications.

But the second thing is that Open RAN architecture provides an openness with which you can provide AI/ML-driven applications, so-called, "accepts," with which you can optimize the network performance. And this is for me a huge potential where I do believe both small and large companies and U.S.-based companies have a chance to compete and actually drive the industry forward.

Mr. Soto. Thank you. My time has expired.

Mr. Latta. Thank you very much.

The gentleman's time has expired.

The chair now recognizes the vice chair of the subcommittee, the gentleman from Georgia, for 5 minutes for questions.

Mr. Carter.   Thank you.   I am down here in timeout.   So you-all look down here.

Thank you, Mr. Chairman, for holding this hearing today.

And I appreciate all of you being here.

You know, to the credit of the chairman -- and I am not trying to patronize him.   I mean this.   This committee has made it our mission, our goal, if you will, to help close the digital divide and promote innovation from here in America.

We recognize that we are the innovators, that we are the leaders here in America, and that is extremely important.   That is an important responsibility and something that we take very serious.

And I reiterate what you have heard thus far, and that is that we have got to lead the way in innovation, especially when it comes to Open Radio Access Networks.   I appreciate everyone being here.

Mr. Blum, I will start with you.   We have got new vendors who are starting, who are entering the market.   And we have an agreement, and we got an agreement on standards.   We have got funding from the government.   What are we missing?   What else do we need in your opinion?

Mr. Blum.   I think Congress has really done an excellent job of giving us the tools to spur the ecosystem.   The Chinese vendors, they hate Open RAN.   Why?   There is competition.   There is transparency.   There is security.   There is U.S.-centric leadership.   There is U.S. software, and no one does software better in the world than the United States.

I think having the agencies, Congress, and us as carriers and vendors go to the rest of the world, talk about our experience, our success are the best ways to have an alternative to the Chinese vendors.

Mr. Carter.   Right.

Mr. Blum.   We now for the --

Mr. Carter.   Right.

Ms. Blum.   -- first time have a real alternative.

Mr. Carter.   Ms. Rinaldo, what about you?   What do you feel?

Ms. Rinaldo.   No, I absolutely agree with it.

We need to make sure that the government continues to show support by holding hearings like this.   Again, we are in a bit of a cyclical market in the telecom industry.   So we need to know that there continues to be excitement behind Open RAN, we still continue to deploy.

As you are taking codels and talking to your counterparts around the world, encourage them to be in contact and see how they can move to an Open RAN system.

You know, funding, we have the NTIA fund.   We also have the ITSI fund which is out of the State Department, and that is providing developing nations funding so they can move to more secure systems.

Mr. Carter.   Good.   Good.

Mr. Baker, I understand that the standards are voluntary.   So how does Mavenir work with other vendors to ensure that they are using those standards and they are interoperable with your equipment?

Mr. Baker.   Yes, very good question.

Mavenir spends a lot of time cooperating with other vendors to improve the

integration of the Open RAN alliance specifications. As an example, you know, we have a 10,000-square-feet testing integration facility that we invested in in Dallas, where we have tested over 14 different radio manufacturers from around the world to ensure the specifications work.

I think the challenge that is going forward is that there is actually no commitment necessary to say something is O-RAN compatible.

Mr. Carter. Uh-huh.

Mr. Baker. And, you know, that is really the request that, you know, government looks at this on a global basis and come up with something like the WiFi standards where everybody knows that WiFi is compatible. And the same thing needs to happen with O-RAN, and O-RAN interfaces need to be --

Mr. Carter. Right.

Mr. Baker. -- standardized in equipment.

Mr. Carter. Well, thank you.

Folks, I have got the honor and privilege of representing the First Congressional District of Georgia. We have a strong military presence. We have Fort Stewart. We have Kings Bay Naval Base, Hunter Army Airfield.

And, you know, it is very important with our military heritage that these issues -- and these issues are obviously extremely important to me.

Mr. Blum, in your testimony you discussed that DISH has partnered with the U.S. Navy at Whidbey Island in Washington to deploy a private Open RAN network on the base. And I understand that the last NDAA, in fact, I know, requires that the Department of Defense to look at deploying wireless networks based on Open RAN.

How would the Department of Defense's deployment of O-RAN networks assist

broader O-RAN development?

Mr. Blum. I think DOD's interest in support of Open RAN is very important. And the success of the project in Whidbey Island, it was a private 5G network, using Open RAN for air fighters coming in, for fueling and maintenance. And we want that expanded. The DOD has their own unique needs, as you know well.

Mr. Carter. Uh-huh.

Mr. Blum. Open RAN allows that customization. We can give them the security layer. We can give them the flexibility for operational, mission-critical types of projects where the legacy they just don't have that nimbleness.

As Mr. Baker referenced, Open RAN can be constantly upgraded, and it is future-proof. So the DOD may have certain needs now on a military base. Those can be expanded over time without additional costs because the network is primarily software-based.

Mr. Carter. Great. Great. Well, I am out of time.

But I do want you to know, again, that this committee, and specifically this subcommittee, is leading the way in this type of innovation. So thank you-all.

And I yield back.

Mr. Latta. Thank you very much.

The gentleman's time has expired.

And the chair now recognizes the gentlelady from California's 16th District for 5 minutes of questions.

Ms. Eshoo. Thank you, Chairman Latta and Congresswoman Matsui, for leading the charge today.

And to each of the witnesses, I think you have made this a -- we know it is

important, but you have made it fascinating. So thank you.

I have been raising the alarm about the presence of untrusted equipment in our networks, i.e., Huawei and ZTE, for over 15 years so, you know, for the Congress, for the FCC, for so many to recognize today that we have to take this very seriously. This is about our national security. And so today's hearing, I think, is in so many ways, music to my ears.

Now we established rip and replace. There is a requirement to rip, but there is not a requirement to replace. And I have paid close attention to what each one of you have said in answering other questions.

What is the major stumbling block to replace? Is it a partnership with the government because there are so many smaller stakeholders that need money, that need the help? And if so, tell us what you think we should do additionally to what we have already done. I mean, it is my understanding that there was -- we were funded at $2 billion. It was understood that 5 was the number that would really speak to 100 percent of the pie, or pretty close to it, because we can't be self-congratulatory until this, you know, this interoperational policy is in place.

I mean, you can have just a couple of places that create a real national security headache all the way to a nightmare.

So who would like to fill in on this and tell us --

Ms. Rinaldo. I am happy --

Ms. Eshoo. First about the money, is it money?

Ms. Rinaldo. So it is money.

Ms. Eshoo. Everything almost always is.

Ms. Rinaldo. It is always money.

Ms. Eshoo.   So you know --

Ms. Rinaldo.   So "yes" to money.

Ms. Eshoo.   -- you won't be offending me if you say it is.

Ms. Rinaldo.   So I would say when the FCC started going down this path, they included us in what we -- a B-to-B exercise, where our vendors were able to give a quick 20 minutes here is what we have to offer to the rip-and-replace recipients.

So I would say at that time was in late 2020, early 2021, Open RAN was still a nascent conversation.   I think if you were to do it again today, it would be a whole different ball game.

Ms. Eshoo.   And it hasn't been done today?   Is that what you are saying?

Ms. Rinaldo.   No, it hasn't been done today.

Ms. Eshoo.   Okay.

Ms. Rinaldo.   Congresswoman --

Ms. Eshoo.   That is an easy thing to request the chairwoman and the commissioners to sponsor.

Anyone else?

Mr. Blum.   You are right.   It is the rip.   And then replace with what?

Ms. Eshoo.   Yeah, I don't know if every Member realizes that, you know.   We run the words together, but the first part is required.   The second part is not.

Mr. Blum.   Yes.

Ms. Eshoo.   Now, you know, there would be different ideas about requirement on the second part of it.   And if you think that that is appropriate, someone should tell us.   But I really want to know in terms of brass tacks what else you think we need to do so that this is a ubiquitous system?

Mr. Toivo.   Can I add something?

So, obviously, money is needed.   But I think based on what the esteemed colleagues have also discussed here, I think these smaller operators, they need -- they can't do this, they can't build the car themselves, if I refer to my testimony.

So I think this would be a real opportunity for having a set of configurations that get certified end to end, and are made easy to deploy at the cost-effective way using that money sensibly.

So for me that could be one way to advance the certification approach.

Mr. Baker.   Yeah, I think there is one, there is one limitation in the rip-and-replace program that is actually in the back of minds of all the operators.   It is a rip and replace on like for like.

So we are actually going through this transition from 4G to 5G.   So we are actually having to install 4G equipment in a network which actually should be upgraded to 5G.

Ms. Eshoo.   Ah.

Mr. Baker.   So there is actually a real challenge there.   And if the rules could be changed that the networks could be upgraded to 5G, I think that is a great opportunity to put Open RAN in for 5G.

Ms. Eshoo.   I think I am going to make you very happy, Mr. Chairman.

I yield back.

Mr. Latta.   The gentlelady does yield back the balance of her time.

And the chair now recognizes the gentleman from Florida's Second District for 5 minutes for questions.

Mr. Dunn.   Thank you very much, Mr. Chairman.

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I think it is incumbent on us in Congress, you know, to pave a path forward for the American commercial enterprise to be able to compete with China's rapid technical development and their Digital Silk Road companies, while ACT, we mentioned, you know, they are rapidly building blocks for 5G digital dominance. And we spend a lot of time here in Congress talking about the threats from Chinese applications, apps like TikTok and whatnot.

But I think it is also very important that we realize that if China wins the 5G race and develops the software that rides on top of the next-generation networks, I worry that they will leverage that against us and across all of our sectors -- energy, healthcare, military, everything.

So as we have already discussed today, the Radio Access Networks, RANs, connect devices to core network through a radio link. However, due to high barriers to entry, the RAN marketplace is consolidated over time and leaves fewer options for trusted network equipment.

Everybody in the room is concerned about Chinese dominance of 5G technology and what it means for national security, as well as the future of our children.

Fortunately, I think we are working together, policymakers and industry, toward solutions to fix that, those issues through V-RAN and O-RAN, which have great potential to improve our security.

Screening and protecting America's global competitiveness, it does require a multipronged approach. So not only do we continue to support R&D and O-RAN, vRAN but also the spectrum authorities, that we have to renew the spectrum authorities and sell spectrum.

So and rip and replace is -- I heard them say rip. I like that, rip. And I think we

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have to replace, too, unfortunately. We can find the Federal funding like that to pay for it. I mean, that is simply by renewing the spectrum options. I mean, So I think it is pretty obvious.

Chinese Huawei and ZT equipment are serious, are -- services largest equipment manufacturer globally. But we continue to use them, despite our Act that we passed back in 2019, Secure and Trusted Communications Networks Act, that specifically was designed to combat us using those -- those software.

So, I think they are leveraging American dependence already on using it for cyber attacks and collecting data and whatnot. In fact, we found out last week that the famous Chinese spy balloon that went overhead actually called back to China, got the data back to China through one of those networks. Amazing.

So I am looking forward to solutions from people like you.

Mr. Blum, you mentioned how most of the world's wireless networks are constructed over decades and are heavily reliant on end-to-end closed-technology equipment systems, provided usually by a single vendor like Huawei or whatever. DISH didn't want to be locked into that apparently, and so they inter -- that prompted them to make an O-RAN architecture.

I'm told by 2027, China is going to have four times the 5G spectrum that we have. Can you expand on how China is using those Huawei and spectrum policies and whatnot to get ahead and what the risk is to the United States economically and national security?

Mr. <u>Blum.</u> I agree, Congressman. Spectrum is a critical input. We could build the best network. But if we don't have sufficient spectrum as a country for 5G and 6G, we will be falling behind China.

You know, our near-term opportunities, besides reauthorizing the FCC spectrum

authority, today at the FCC they are considering unleashing 500 megahertz of mid-band spectrum for fixed broadband here in the United States in the 12 gigahertz band, so something they could do immediately without Congress acting on spectrum authority. But it is getting more spectrum in the pipeline.

We, too, are concerned about Chinese vendors and why we think Open RAN has two characteristics that help. One is on security. The second is on silicon and chip sets. Huawei makes a very, very good chip.

With Open RAN, we are able to plug in the latest and greatest chips from NVIDIA and Broadcom and Intel. Just take it out and put something new in. That will allow the U.S. to compete against the Chinese vendors the cost of Open RAN.

Second is security. What Open RAN allows, you are always going to have intruders, as you noted. Open RAN, the lights are on. You are always going to have cockroaches. It is the metaphor that we use. With Open RAN, you can see them and you can kill them. In a closed legacy system, you may not even know they are there.

Mr. <u>Dunn.</u> I thank you.

I have other questions, but I can see I am running short on time. I thank this very erudite panel for sharing time with us today.

Mr. Chair, I yield back.

Mr. <u>Latta.</u> Thank you. The gentleman yields back.

And the chair now recognizes the gentlelady from Illinois' Second District for 5 minutes for questions.

Oh, sorry. Oh, I am sorry. Oh, I am sorry.

I apologize. I even had your name circled to make sure I came back.

The chair recognizes the gentleman from Texas's 33rd District for 5 minutes for

questions.

Mr. <u>Veasey.</u>   Mr. Chairman, thank you very much.

And Mr. Baker, I am going to start with you and, you know, because of where you are located, you know, the growth in Texas from all around the world has been absolutely tremendous.   And your accent is normal in Texas now --

Mr. <u>Baker.</u>   Eastern Texas, yes.

Mr. <u>Veasey.</u> -- with all the growth that we have had.

And I want you to talk a little bit about, if you can, about the expansion and exception of technology like O-RAN and how it helps creates jobs in places like Texas and jobs in investment and educational and training opportunities.

Mr. <u>Baker.</u>   Yes, so Mavenir is, you know, 19 years, looking at software virtualization, headquartered in Richardson, Texas.   In Open RAN, we have invested over half a billion dollars in R&D and facilities in the Texas region with a billion amp, power amplifier radio capability in the Richardson office.

The U.S. actually lacks the capability of building radios at scale, and is still very dependent on international sources for buying radios for even Open RAN networks.   So we have built a capability with world-class test chambers and world-class engineers, actually recruited from the competitors.   And alongside that, built a very large system and integration center, as well, to cope with all the different integration work that needs to go on with Open RAN.

So in that respect, you know, we are investing.   Last year we actually did recruit, even, you know, in the hard climate that is going on in telecommunications.

So the challenge that companies like Mavenir have is the ability to scale and grow through the access of working capital.   If we can get access to working capital more

easily for highly leveraged companies, then we can be recruiting and building up the Texas capability to a far greater level.

Mr. Veasey. Yeah, just out of curiosity, in a company like yours, is it important for people to be there? Or do people, are most people working remotely? How does all this sort of come together from an intellectual standpoint? Is it do people, are people needing to collaborate in person with each other?

Mr. Baker. Yeah, so I am a firm believer that people need to get together to collaborate. So, you know, but COVID taught us how to work remotely and, you know, the good thing about software development is that, you know, most people spend time on terminals. Our radio engineers, our hardware engineers do spend time in the office and, you know, because they need to use all the test tours and the facilities because it is very, very capital intensive and those tours are not available remotely.

Mr. Veasey. Yeah, I think it would be very interesting to further this debate and think about the future and is it more advantageous for Americans working in this particular field, for us to be at home or work working back in the office, because the remote office or the remote office is going to be such a part of our reality now.

Mr. Baker. Right.

Mr. Veasey. But how does it hurt or help?

Mr. Baker. Personally, I believe in collaboration and, you know, people need to collaborate both, you know, over the Internet and face to face.

Mr. Veasey. Yeah, yeah, absolutely.

We also discussed the importance of funding Public Wireless Supply Chain Innovation Fund, which helps promote O-RAN. In order for O-RAN to succeed here and abroad, public-private partnerships must be in place to help American and allied

manufacturers reach the level of competitiveness required for places like against China, for instance.

And I strongly believe that the foundation of this competitiveness lies in creating and maintaining a diverse supply chain of vendors here at home who can help us and our allies gain that competitive advantage.

Beyond funding, what challenges are smaller companies confronting as far as developing the most reliable and cost-efficient O-RAN technology? And what steps can Congress take to make sure that smaller players are maximizing their potential in the marketplace?

And any of the witnesses can answer that.

Ms. Rinaldo. Thank you, sir. I appreciate the question.

Yeah, so our small businesses, our innovators are the lifeblood of the Coalition. We are very excited that NTIA delivered their first grant from the wireless fund to a small business, DeepSig, that does AI work.

We are in the downtrend of the market here in the United States right now. So it is all about how can we ensure that they are in a good place where they can catch the up-wave when it comes for 6G and opportunities for them globally that are building out 5G networks.

So another thing that I think would be incredibly helpful to small businesses is how can we support them in getting to standards bodies where they are doing that innovative work, they do have the smaller teams, they are more constrained on resources, funding, and the man-hours.

So that is one thing that the NTIA fund could be a good use for is to help support businesses at standards bodies.

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Mr. Veasey.   Thank you.   Thank you.

I am pretty much out of time.   Thank you, Mr. Chairman.

I yield back.

Mr. Latta.   Well, thank you very much.

The gentleman yields back the balance of his time.

The chair now recognizes the gentleman from Pennsylvania's 13th District for 5 minutes for questions.

Mr. Joyce.   Thank you, Chairman Latta and Ranking Member Matsui, for having this hearing on Open Radio Access Networks, and thanks to our distinguished panel for being here.

As we come off of the World Radio Conference, more than ever we must continue to sustain the United States as the leader and innovator in the wireless space.

Open RAN is one area that will spur continued competitiveness and American leadership.   We need to support its growth.   Open RAN revenues are forecasted to be more than $6 billion by 2027, showing how operators have begun to shift more towards trusted vendors and this technology.

Supporting Open RAN with trusted vendors is especially important because Chinese companies like Huawei are sending their equipment to operators rapidly and globally.

I think we can all agree that this poses a multitude of security risks.   We must ensure that our policies are not hindering the development and the deployment of trusted equipment and slowing our competitiveness.

Mr. Toivo, there are significant indicators of top-line growth.   How do you believe that U.S. companies will benefit from the evolution of networks towards Open

RAN?

Mr. Toivo. Thank you.

So first of all, just moving to Open RAN from closed systems, by definition, increases the share of U.S. companies for the fact that, instead of having purpose-built hardware by incumbent vendors, Chinese or others, we talk about, of course, continued chip sets. But also servers and increased amounts of software, as some of my colleagues said, largely come from the U.S. vendors.

We made an actually rough estimate that the platform for an Open RAN deployment, about 30 percent of the value in that would stem from U.S. vendors. And that is without the actual RAN piece, the RAN logic, and the RAN software that the likes of Mavenir would provide on top of it.

So the fact that we just drive towards Open RAN becoming the way to do it will automatically increase the opportunity for U.S. vendors.

The other thing is to work internationally with some of the large markets. So to reach scale for RAN networks in general, as China is not an open market for any of the trusted vendors, Western vendors, India is extremely essential. India is the second largest market in the world.

So we need to facilitate cooperation, both on political level between India and the U.S. and other trusted nations. And we need to make sure that the U.S. vendors are able to operate and create solutions that also are competitive in the very cost-sensitive Indian market.

Mr. Joyce. Ms. Rinaldo, DISH has deployed an all-Open RAN network, while AT&T hopes to have the majority of their traffic over Open RAN networks by 2026. When do you think we will see more networks like these deployed? And to use your

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analogy that you stated earlier, will industry continue to skate to where the puck is?

Ms. Rinaldo. Yes, absolutely. I think that, as additional spectrum comes online, that is why spectrum authority is so incredibly important. We will see a move to Open RAN, and it is very exciting to have DISH.

And I will say that poor Jeff has to do so many global meetings now because he is being requested. As we are having conversations around the world, carriers, global carriers are looking to DISH for some insight onto their journey throughout this process.

Mr. Joyce. Ms. Rinaldo, it is clear from this hearing so far that O-RAN has a multitude of security and economic benefits as these networks begin to be deployed.

As a follow-up, what policies or actions should Congress be taking to support companies and vendors who participate in and deploy these Open RAN networks?

Ms. Rinaldo. So we appreciate everything you have done with the NTIA funding. Also the State Department money is incredibly important. That was a much smaller pot of money. But how can we get our global allies around the world and incentivize them?

And, again, I mentioned in my testimony, making small tweaks to EXIM and DFC, we have the tools. They already exist. We need to make them more workable for the telecom because it is such a debt-heavy industry.

Mr. Joyce. Mr. Baker, Mavenir is a trusted vendor. It is a trusted vendor to 250 mobile operators around the world.

Do you agree with Ms. Rinaldo's assessment? And what other ways can we support trusted vendors?

Mr. Baker. Yes, certainly I agree with her assessment. You know, the world is moving in the right direction. More spectrum will give the ability to build more Open RAN networks.

And I think there is two versions of 5G also out there. There is 5G non-standalone and 5G standalone, and 5G standalone gives the operators the benefit to move to a different vendor for the complete network.

So there are some great opportunities out there that need chasing. You know, it is about the ability to, you know, cover the debt and cost of actually, you know, building these networks as the, you know, as the opportunities present themselves.

Mr. Joyce. Mr. Chairman, my time has expired.

And I yield.

Mr. Latta. Thank you very much.

The gentleman's time has expired.

And the chair now recognizes the gentleman from California's 29th District for 5 minutes for questions.

Mr. Cardenas. Thank you, Mr. Chairman Latta and Ranking Member Matsui, for holding this hearing.

And I also want to thank the witnesses for being here and providing year expertise and your opinions today.

Many of you made reference in your testimony to the importance of advancing America's leadership in wireless and 5G. We have also talked a lot about the need to outcompete adversaries, like China, in the telecommunications space.

I think there these are important goals, but I also think it is helpful to highlight why these pursuits are so important and why they should be our priorities.

Mr. Blum, can you talk about how the U.S. maintaining strong global wireless leadership benefits the average American person?

Mr. Blum. Yes, Congressman. O-RAN allowed DISH to enter the wireless

market against three big incumbents, because O-RAN allowed us to deploy more quickly at lower cost. We are now the number four, trying to compete against AT&T, Verizon, and T-Mobile.

You have been a champion of competition. We want to do that. Our subscriber base is dwarfed by the 120 million subscribers that the incumbents have each, and O-RAN puts us at a good start.

But there is policies that the FCC and Congress can implement to promote competition. But our hope is, because we built the network at a lower cost, those benefits could be passed on to consumers at lower prices. And today, we have competitive prices in the market, $10 for 1 gig. We have $25 unlimited plan.

So we are trying to compete, and we appreciate all your help in promoting competition.

Mr. Cardenas. Thank you.

So more competition and lower price is good for the consumer, good for the American people?

Mr. Blum. Exactly.

Mr. Cardenas. Thank you.

As with any new technology, it is important that we are thoughtful about the approaches in making sure that the benefits of its reach that reach all the people throughout the United States.

Mr. Blum, in your testimony you referenced the increase in vendor competition that comes with the use of Open RAN and the effect this can have on lowering prices.

What benefits do you envision DISH's use of Open RAN technology offerings low-income consumers, and what are you doing to ensure that those benefits become a

reality?

Mr. Blum.   The fact that Mavenir has to compete against Samsung, so they are both competing on the software, that is a good thing.   They want our business, and so we can pass those costs on to consumers in terms of lower costs and also higher quality because they are making better software.

For lower-income communities, we have thousands of stores, Boost Mobile stores in many communities of color, lower income.   The thing that we are most concerned about right now which I know this committee is working on, is the ACP funding going away.   We need to pass, Congresswoman, your bill, very quickly.   There are 25 million households who, in April, could lose connectivity, despite, you know, the service.

And we are hearing from folks who have the ACP funding that that is the only way they are connecting.   They can't necessarily afford Fios.   And if they lose that connection, it would be very, very harmful.

So the most important thing that needs to be done to protect those communities right now is refund ACP quickly.   We are going to have to start stopping signing up new subscribers in 2 weeks.

Mr. Cardenas.   Thank you.   That is 25 million houses of men, women, and children, kids that need to do their homework, et cetera.

Manufacturing plays an important role in the local economy in my district. Mr. Baker, you spoke about the importance of the public sector supporting Open RAN manufacturing and what it can tell us.

Can you tell us more about the impact of that public investment in Open RAN technology and that it has on manufacturing in the United States, and how will investments like those in the CHIPS Act help these efforts?

Mr. Baker. Yes. So certainly through the CHIPS Act, you know, the incentive to move the silicon foundries back to the U.S. is a great step forward. Now we need to take that another step forward and turn those into finished products, using those chips, you know, with the necessary pricing arrangements to, you know, ensure the U.S. can compete in the manufacture of world-class radios and other hardware that is necessary for Open RAN networks.

Mr. Cardenas. Thank you.

Now my last question is for Mr. Toivo. Can you talk about how Open RAN impacts connectivity technology convergence across fixed and mobile networks where customers have seamless connectivity, and what wired network needs does Open RAN need to make it a reality?

Mr. Toivo. So Open RAN obviously needs fiber closer to the base stations because that is what we need to deploy 5G and eventually 6G. So I believe that is actually a beneficial ambition because that same fiber build-out can also be used to cover WiLine services to customers, private as well as businesses.

Secondly, we also have, already, cases where Open RAN is used for providing fixed wireless services in areas where it is not meaningful to bring the fiber all the way to the home. So I think that is a mutual beneficial development that I think is going to help both Open RAN and the broader fixed -- broad fixed fiber rollout.

Mr. Cardenas. Thank you.

Thank you, Mr. Chairman. My time expired.

I yield back.

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

And the chair now recognizes the gentleman from Georgia's 12th District for 5

minutes for questions.

Mr. <u>Allen.</u>   Thank you, Mr. Chairman.

This is an important hearing, and thank you for being here and giving us your expertise.   This is -- this landscape is rapidly shifting towards software-centric models.

Continuous advancements in software and chips sets play a crucial role in enhancing computational speed and overall efficiency.   This is particularly relevant in updating network software quickly and optimizing performance.

Open RAN proves instrumental in embracing the latest technology seamlessly. Unlike the traditional proprietary route that often involves delays or compatibility issues, Open RAN allows for swift integration, making it easier to bolt onto new advancements.

Obviously, standardization is needed to spur innovation in these sectors. Leveraging Open Radio Access Networks can revitalize the American telecommunications manufacturing industry, and can make our existing telecom companies more efficient.

Mr. Toivo, can -- did I get that right?

Mr. <u>Toivo.</u>   Yes.

Mr. <u>Allen.</u>   Okay.   Good.   Thank you.

Can you discuss why testing and validation is so important for Open RAN deployment?

Mr. <u>Toivo.</u>   So in general, to create the high-performing RAN system, there is extensive testing that needs to be done, regardless of if it is Closed RAN or Open RAN.

And to advance Open RAN, I think the initial grants from the wireless innovation fund have been well-placed in creating more infrastructure, lab environments needed for perform extensive Open RAN testing.

What we need beyond that is to be very clear on what are we testing against that

we have, and that is particularly important for smaller vendors so that they know what constitutes successful performance of their products and how their products should work as part of a larger system. That is where the certification proposition comes forward that Mr. Baker, as well as myself, are putting forward.

Mr. Allen. Is NTIA recognizing this need as they award grants?

Mr. Toivo. Obviously, the initial grants have been to create the infrastructure for testing. I both believe and hope that future grants will focus also on the actual process and the development of that regime that is needed to use those investment in the most effective way.

Mr. Allen. Okay. Thank you.

Mr. Blum, in your testimony, you note that DISH has built its Open RAN network to cover 73 percent of the U.S. population in just 3 years.

What has the impact Open RAN played in helping build your network to achieve that coverage in such a relatively short time?

Mr. Blum. We wouldn't have been able to do it if we used the old technology. Open RAN, because it is software-based, allowed us to turn on about 1,000 towers a month. All we had to do is put the radio up, and we have a very modest footprint. We don't have the big -- you know, a cell tower today, you see big sheds of equipment. We don't have any of that. Ours is 5 by 7 because everything is in the cloud.

And the speed that O-RAN allowed us to put up our network is why we were able to cover 37 percent of the U.S. population.

Mr. Allen. You also mentioned added security for Open RAN networks. How does Open RAN provide transparency and insight into the whole network?

Mr. Blum. It is what I said earlier where the lights are always on. Networks are

complex, but we thought about security from the very beginning and designed our network to be secure. So we are able to see every aspect, from the antenna, from the radio, from the core, from the traffic flow to the cloud.

And all that data, and using AI, will allow to us detect intrusions. We are not going to be able to stop people trying to hack our network, but how do you deal with it is the key thing. And we believe that O-RAN networks can be more secure than legacy.

As Mr. Baker mentioned, hackers are going to get more and more sophisticated. They are daily. O-RAN allows us to upgrade the network. We are on version 35 of Mavenir software. Legacy carriers could do it maybe once or twice a year.

Mr. <u>Allen.</u>   Okay.

Mr. <u>Blum.</u>   So O-RAN can keep pace with the hackers through upgrades.

Mr. <u>Allen.</u>   Mr. Baker, I got about 20 seconds.

How does AI help us with the hacker problem?

Mr. <u>Baker.</u>   It will certainly give us the intelligence to start to look in the right places where the hackers get in there and do advanced testing.

Mr. <u>Allen.</u>   Okay. All right. Thank you so much for your time.

And I yield back.

Mr. <u>Latta.</u>   Thank you. The gentleman yields back the balance of his time.

And the chair recognizes the gentlelady from Illinois' Second District for 5 minutes for questions.

Ms. <u>Kelly.</u>   Thank you, Mr. Chair. Thank you for holding this hearing, and thank you to the witnesses.

Mr. Blum, in your testimony, you highlighted how you think Open RAN wireless networks like DISH are best suited to serve as private 5G needs, and mentioned a private

5G network you are currently deploying at a U.S. Navy base.

Given my district encompasses both urban Chicago, suburban, and rural -- I have 2,000 farms in my district -- I expect that the private 5G needs will vary from big companies and institutions with deeper pockets to be smaller and midsize ones that are more cost-constrained like local hospitals.

What do you envision the advantages will be for Open RAN servicing these needs?

Mr. Blum.   We are very excited about the opportunities for private 5G for small and large companies, and one of the benefits of Open RAN is flexibility.   We could design a private 5G needs of a small hospital in your district.   We can also design it to meet the neat of a larger hospital because it is very flexible.

Some may want certain features.   Others may want different things, but Open RAN gives us that flexibility, because it is software-based, to talk to the hospital.   What do you need?   And then we can deliver it.

It is not going to be one solution that is really expensive, that has to -- can't be modified.   It is the modification and customization and flexibility that we are excited about.   And we are talking to a lot of companies about private 5G, and they are trying to figure out their needs.

I understand that some of the hospitals in your district, there were security issues. With -- protecting patient data is critical.   In a private 5G network, the data never leaves the hospital.   It is always there, resides with them, and they can control that.   And that is an important part of what Open RAN can bring to private 5G.

Ms. Kelly.   Just out of curiosity, you all can answer.   But when I am listening to all of you, I am wondering about the workforce.   And are you finding that people are trained and prepared?   Or do you have a lot of job openings in what you do?   Or, you

know, what are your concerns around that? Anybody or everybody.

Mr. Baker. I think it is creating jobs. It is the merger of the RF industry and the internet together. And so, you know, creating new skills in AI, RF, software engineering altogether is a great opportunity for growing careers in the future.

And certainly I think, you know, it's reinvigoration of the wireless industry. And, you know, the operators will take more opportunity to develop products themselves. So you are going to see development move into the operators. And we are seeing that with the likes of VT Vodaphone, even DISH, developing software features to running these networks themselves.

So they, you know, the operators will clearly differentiate these networks with their own features and need the skill sets to actually go do that so that, you know, in terms of creating jobs.

Mr. Toivo. I agree with Mr. Baker that, first of all, this is an opportunity. This brings excitement to an industry that might not have been the first choice of graduates, telecoms, so to say.

Secondly, I think it is both an opportunity, but also a need to drive upskilling. And we are actually working, Telecom Infra Project, together with many of our vendor colleagues, including Mavenir, to -- we are producing something called a TIP Academy for Open RAN.

So we are making upskilling and training available online to facilitate the transformation of the workforce that is needed.

Ms. Kelly. Oh, fantastic.

Ms. Rinaldo. And I would just add one unique part of Open RAN is the Radio Intelligent Controller, and that allows for an app system. And so there is a whole new

host of jobs that will be created because of the apps that will soon be created. So we, the Open RAN still has a long runway of innovation to occur.

Ms. <u>Kelly.</u> I just want to make sure that people are trained for the jobs, you know, that can take advantage.

Ms. <u>Rinaldo.</u> Oh, absolutely. It is incredibly important.

Ms. <u>Kelly.</u> Thank you so much.

And I yield back.

Mr. <u>Latta.</u> Thank you.

The gentlelady yields back.

The chair now recognizes the gentlelady from Tennessee's First District for 5 minutes for questions.

Mrs. <u>Harshbarger.</u> Thank you, Mr. Chairman.

Thank you all for being here today.

You know, competition makes everything better, doesn't it? And it can lower network costs.

And, Mr. Blum, you talked about when it came to competing on software. So I guess my question to you is: What led to DISH's decision to build an Open RAN network? I mean, did you consider a closed network before doing that?

Mr. <u>Blum.</u> We considered it. But our founder, Charlie Ergen, when we entered the satellite business 40 years ago, you need a paradigm shift in technology to compete against the incumbents. If we just did the normal thing, what everyone else had done, we wouldn't have been able to compete.

So Charlie hired a great team of engineers, as I said, traveled, you know, the world. And we realized very soon that the only way for us to compete was this

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paradigm shift in technology, Open RAN and 5G.

And to be able to build out this network in 3 years gives, you know, gives me an enormous sense of pride. I think we made the right decision, and hopefully, we have created an ecosystem so other carriers who want to compete can do the same in the future.

Mrs. Harshbarger. Absolutely. I am sure you had difficulties. What kind of cost savings, I guess, did it create for you?

Mr. Blum. We believe the cost savings are significant because in legacy systems, the largest cost is sort of the radio. And then you are buying every piece of it from one vendor. And if you could only buy from one person, the costs are not going to be low.

We are able to buy from 80 different vendors, and they know they may not be in our network if they are not offering a good price, and a good, quality product. So that is really what is driving the price down.

It is also the software-based nature of the network that you don't need as much hardware. You don't need as much cooling. You don't need as much cabling. And that lowers costs as well.

Mrs. Harshbarger. Yeah. Well, you know, you got the $50 million contract from NTIA. Congratulations.

And when you described field testing, it sounds just like going through the drug process with the FDA. It is not going to be easy.

And I guess my question then to you and to Mr. Baker is: Can you describe this project and when you expect to have it completed?

Mr. Blum. We will stand up the lab in 6 months. You are welcome to come out and visit our Cheyenne facility. You are also all of you are welcome -- and I know some

of you have already -- visit our wireless headquarters. We have our network operation center. You can see Open RAN in action.

What was interesting is right after we announced the award, vendors were reaching out to us, excited, like, Oh, I read about Orchid. How do I apply?

We didn't even -- one day the grant award. So we hope to get the lab up and running as quickly as possible, start taking applications, and start testing.

Mrs. Harshbarger. Yeah, that is awesome, very awesome.

Mr. Baker, from a purely business standpoint, it would seem that there is -- there are natural difficulties with getting different vendors to cooperate, because you made a statement that it is hard for small companies to meet criteria volumes to get pricing due to their size.

And I see that in the independent pharmacy world. It is hard for us to have buying power when we are so small and we don't have that overarching big name.

So what, if any, incentives would vendors have in making their technology interoperable?

Mr. Baker. Yeah, so I talk about co-opetition in the marketplace. And so it is Open RAN is all about cooperation and then competition.

On software then, you know, we, Mavenir has proven that you can compete head-on with incumbents on a global basis in providing mobile access, mobile products. The challenge comes in the hardware, and it is really the -- and I would say, it is probably the old way of pricing effectively in a way that, you know, every company pays the price, depending on the volume that they purchase.

That sort of needs looking at in a sense because, you know, a chip, you know, comes off the same slice as a silicon that some other large manufacturer is buying, as

well. So the cost to manufacture silicon is probably very similar. So, you know, there are some things that the industry can do to look at how chips are priced and how people can compete.

And to the extent that the more standardization that is used in Open RAN hardware products, the more common components are used, and hopefully the industry will coalesce around giving a uniform price for that one volume component to be used. And then we can compete head-on, you know, with the incumbents as they stand today.

Mrs. Harshbarger. Yeah, well, we want the price to go down and service to go up.

Mr. Baker. Absolutely.

Ms. Harshbarger. That is what make competition so grand.

So I appreciate your answers.

And with that, Mr. Chairman, I yield back.

Mr. Latta. Thank you. The gentlelady yields back the balance of her time.

And the chair now recognizes the gentlelady from New York's Ninth District for 5 minutes.

Ms. Clarke. Thank you very much, Chairman Latta and Ranking Member Matsui.

Good afternoon, everyone. And I want to thank our leadership for convening this important hearing today, and thank you to our esteemed panel of witnesses for the work that you do to keep Americans connected, and for joining us today.

The deployment of the fifth-generation, or 5G, wireless technology has sparked a cycle of innovation that has powered the rise of smart home and smart city technologies that individuals and businesses alike have come to rely on. And the ongoing development of 6G promises even further growth in this space.

As our witnesses have made clear, advances in Radio Access Network technology like Virtualized Radio Access Networks, or vRAN, and Open Radio Access Networks, or O-RAN, presents an opportunity to promote more competition in the marketplace, lower consumer costs, enhance the diversity of vendors, and create more resilient supply chains.

I am proud of the work this committee has done in recent years to facilitate these advances through the USA Telecommunications Act which establishes the Wireless Innovation Fund, and the CHIPS and Science Act which provided the funding necessary for NTIA award grants, supporting the development of O-RAN networks.

NTIA has already awarded nearly $100 million in these grants to bolster our wireless ecosystem, but we cannot rest on our laurels.

As Members of Congress and this historic committee, we must continue working together to ensure our communication networks are the best and most secure in the world.

That is why it is critical that we provide continued authorization, full funding for the Wireless Innovation Fund, as well as for the Federal Communications Commission's rip-and-replace program which seeks to guarantee that our networks only utilize equipment from trusted and telecommunications manufacturers, as Representative Eshoo indicated that we are actually indeed replacing.

As we get further into what may be a historically polarizing election year, we cannot lose sight of these shared goals.

My first question is directed to all of our panelists. As we pursue continued American leadership for the next generation of wireless technology, what factors should be top of mind for policymakers to consider as we work to bolster interoperability and

security in our current communication networks?   And how can we best balance the

needs of today with the desire to future proof the regulatory landscape in a way that

continues to foster innovation?

This is an unedited transcript. The statements within may be inaccurate, incomplete, or misattributed to the speaker.

[4:14 p.m.]

Ms. Rinaldo.   Thank you so much for the comment.   I will start.   So it is, I think it is incredibly important.   There are so many different facets of this conversation and that we need to juggle them all at the same time if we are going to be successful.

We need to look about standards, research and development, deployment. There are lots of things that this committee can do and certainly that Congress can do. Fund rip-and-replace.   If we can't fund it, can we move to a plan B?   Department of Defense, building out 5G here domestically and internationally, what is their funding sources?

There is major moves that government can make to help bolster the entire telecommunications industry globally.

NTIA money, I think they need to cast a wide net, $1.5 billion, only 6 percent of the money has gone out.   I think it is incredibly important, because this conversation is so faceted, that we look at all the different points and what can we fund now -- the radio intelligent controller, the app ecosystem.

The United States and our allies, we want to be the ones creating that.   We don't want to see what happens if a foreign actor that we are not aligned with creates that. Then it is to be done.   That is something that NTIA can help fund and that app ecosystem.

So I am happy to talk further in detail, but I also want to give my witnesses opportunities to speak as well.

Ms. <u>Clarke.</u>   Absolutely.   Would anyone else like to comment?

Mr. <u>Baker.</u>   Yeah.   I think creation of the recognition that U.S. ways of doing things and U.S. technology is better than some -- or better as good as the Scandinavian counterparts.

And then I think through the adoption of U.S. technology into the U.S. telecommunications networks, then the U.S. ecosystem will start to thrive and regenerate itself in the wireless technology area.

Ms. <u>Clarke.</u>   Very well.

Mr. Chairman, I am going to yield back the balance of my time.   Thank you all very much.

Mr. <u>Latta.</u>   Thank you very much.   The gentle lady yields back the balance of her time, and the chair now recognizes the gentleman from the California's 23rd District for 5 minutes for questions.

Mr. <u>Obernolte.</u>   Thank you, Mr. Chairman.

I find the topic of Open RAN to be a really fascinating discussion of American leadership and standards.   You know, for many years, I was a software engineer before I was demoted into full-time public service, and I got to oversee kind of a transition in the software industry from an era when if you wanted something to work, you had to write it yourself, into an era where it was very plug-and-play, where you had functionality offered by operating systems and libraries and engines that you could leverage.

And there is a lot of up sides to that, but a substantial down side is that when a problem arises, you have to figure out if it is your problem or if it is somebody else's problem.

And quite often, everyone blames each other.   Well, it is not my problem.   It

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must be a problem with this module, or this software, or this hardware.

So, Mr. Blum, when you were responding to Congressman Dunn's question, you said something I found interesting. You said, Open RAN has the advantage of the fact that there are always cockroaches, but with Open RAN, you can see them and kill them.

What happens, though, when everyone says that they are somebody else's cockroaches? Does that happen, and how do you deal with that?

Mr. Blum. Open RAN provides accountability because the network is virtualized, and in the Cloud, we see every piece of it. The data that we are getting on the network, so we can see, oh, this is John, there is a major problem with your software, or, Nokia, something's wrong with your core, or, JMA, something is wrong with your antenna. It is that transparency that allows us to root out the bugs and improve the quality of service and make our network optimized and better than it was.

And as a video game developer, you know that every year as the new games came out, you had to take out your -- you wanted to upgrade your graphics card, so it could run and you could have great graphics.

Open RAN allows that plug-and-play on the software level and the hardware level, so the next-generation chip that comes out, we don't need to wait to 6G. We don't need to wait a decade. We could update it in software and put the latest and greatest chip into the networks, and so the quality of service for consumers, for private 5G, can be realized much quicker than legacy.

Mr. Obernolte. But you never have a problem where, for example, you brought up the occasion of a new graphics chip, you know, there is a graphical glitch. Is that a software problem or a hardware problem? It is hard to tell. Does that problem occur in Open RAN too because it seems like it would?

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Mr. <u>Blum.</u>   Yeah, I mean, of course it is not perfect.   And system integration, as I mentioned, is an issue.   We had to become our own system integrator, and accountability is important.

But you are right, it is not perfect when you see, okay, why is there higher latency, for example.   Is that a software issue?   Is that a hardware issue?   And it is being able to have the data to figure that out.   It may not be fully obvious just from the start, but we can figure it out with the data.

Mr. <u>Obernolte.</u>   Oh.   Well, thank you.

Mr. Baker, I had a question about certification because it seems like we are all in furious agreement here that what is really needed is some kind of certification authority that can do testing and evaluation and grant certification to Open RAN components and vendors.

And I think I have heard a couple of people on the panel say, it probably should be a nonprofit.   It should be some international agency that is respected worldwide to minimize the amount of conflict here.

My question, though, is, normally, when you have a certification authority, they are also in charge of the standard itself because as time goes by, the standard has to be altered to grow with technology, to recognize some of the limitations and the changing usage cases.

So is the idea that whoever is granted certification authority is also in charge of maintaining the standard?

Mr. <u>Baker.</u>   No, it doesn't have to be in this case.   In the sense the O-RAN Alliance has written the specifications in a way that has the minimal feature requirements that are necessary for O-RAN products to be, you know, compatible.

So in that sense, the community, you know, if they are all testing to common specs, all testing using common methods, you know, there is 18 integration test centers around the world, these could all be using some common test method, common procedure.

They could be audited through likes of, you know, BSI, through other audit functions, and just like they do with 3GPP today, and then if there is a problem with the spec, you know, it is to the manufacturer or test house to take that back to the O-RAN Alliance and get the specifications changed.

Mr. Obernolte.   So what happens now when there is a disagreement on the Open RAN standard because I am sure that occurs?

Mr. Baker.   Yes.   And through the working bodies -- and actually this is where Mavenir actually invests the majority of its people, in standards.   I think we have over 7, 8 people now today looking at Open RAN standards through the O-RAN Alliance.

And we take those challenges back to the Open RAN Alliance, and we, you know, we actively work to get the specification altered in a way that makes sense for the industry.

Mr. Obernolte.   Well, thank you.   I am out of time.   I am sure we will continue having this discussion.

I yield back, Mr. Chairman.

Mr. Latta.   Thank you very much.   The gentleman's time has expired, and the chair now recognizes the gentleman from Ohio's 12th District for 5 minutes for questions.

Mr. Balderson.   Thank you, Mr. Chairman.   Thank you, panelists, for all being here today.

And my first question for the witnesses, all of you can answer it and however you

would like to start and jump in.

Last week, we had a hearing in the subcommittee about cybersecurity and our communications networks. I believe that it is an important discussion to have when talking about Open RAN networks.

With multiple vendors supplying different hardware and software to make the networks work, it seems like there is an opportunity for our adversaries such as China to infiltrate these networks.

The question is, how can we make sure that China and other bad actors are staying out of Open RAN networks that are being deployed throughout the United States? And start wherever you would like. Ladies first is how my mother taught me, so.

Ms. Rinaldo. No, I appreciate the question. So kind of two parts. I would say that my member companies are competitors and that when you put us up against a Chinese company, our innovation is the best, and our allied companies are the best.

But what happens is the market distortions that we are facing up against. So what can we do? There is the Entity List and U.S. Banned List that prevents them from entering the marketplace.

There is other -- there is other things that are occurring that our intelligence agencies are picking up around the world, and that needs to be shared with my member companies. You know, decisions are being made about future builds, and it is important that my companies know if there is a problem so they are not making decisions.

And as we know rip-and-replace is really tough.

Mr. Balderson. Yes.

Ms. Rinaldo. We don't want to be in this position again. So I think greater intelligence sharing is incredibly important and then just additional R&D. R&D puts us in

a great position in standards, and that is how we are going to ensure that we remain top notch in this industry and that we can continue to lead on 5G, 6G, and beyond.

Mr. Balderson.   Thank you.

Did you want to add anything?

Mr. Blum.   Because Open RAN promotes vendor diversity, carriers could choose not to use the Chinese vendors.   As I mentioned earlier, the Chinese vendors, they hate Open RAN.   They want to control the end-to-end network, and Open RAN is the real alternative to them.

So when we were making the decision to do it with no Chinese vendors, because we had the means to choose the Mavenirs and the Samsungs and the Dells and the JMAs. And that supply chain diversity is what we think will really help other carriers around the world make that critical decision.

Mr. Balderson.   Okay.   Would anybody else like to add?

Mr. Baker.   Yeah, I think one additional piece on that.   The tour is available to the industry now for testing software for security, and we are second to none.

And I think, you know, the ability that now these networks have turned into software, you can hand the software to a third-party or use third-party testers in the development to ensure that you are not taking in code -- bad code from a bad actor, is helping the security of these products, and this becomes a day-to-day practice in the organization.

Mr. Balderson.   Okay.   Thank you.   And then again, all of you can answer this. I have heard some arguments that an Open RAN network could actually be more secure than traditional networks.   Can any of the witnesses elaborate more on why that may be?

Mr. <u>Toivo.</u> I could comment on that. I mean, obviously this is a matter of principle, and as already mentioned by Mr. Blum, that having visibility increases the potential to find any threats and problems.

And I think there is an interesting White Paper written by folks in O-RAN Alliance, actually by engineers from Dell that actually shows historically how opening up, using open interfaces, and also the whole notion of making it available and visible what is part of your system, inherently increases security and the potential to identify threats before they become critical.

So I think there is no doubt among the industry that this is the way we can actually build more secure networks rather than the other way around.

Mr. <u>Balderson.</u> Okay. Thank you.

Ma'am?

Ms. <u>Rinaldo.</u> And I would just add that the Enduring Security Framework, which is made up of the National Security Agency, the Department of Homeland Security, and industry released a White Paper last year, discussing the benefits of Open RAN.

The quad countries -- the United States, India, Japan, Australia -- also released a leaders statement on the benefits of Open RAN.

The Department of Defense is currently testing Open RAN on Whidbey Island in Washington State, and they have announced that they are going to take a serious look at deploying Open RAN here in the United States and globally.

You can get no better stamp of approval than those groups of agencies and countries that Open RAN is operational, functional, and secure.

Mr. <u>Balderson.</u> Okay. Thank you all.

I am close on time so I yield back, Mr. Chairman.

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Mr. Latta. Thank you. The gentleman yields back the balance of his time, and the chair now recognizes the gentleman from Texas' 14th District for 5 minutes for questions.

And just for members, right now, they are still calling for votes at 4:30.

Mr. Weber. So what does that say, I have to be timely, Mr. Chairman? I am just asking.

Mr. Latta. You have 5 minutes, sir.

Mr. Weber. Thank you. You are cutting into my time.

So I have got a good question for you, Mr. Baker. Could you explain what -- because I am a novice at this. Unlike the gentleman from California here, I don't build game stuff. There is some gaming that goes on in Texas, but it is a whole different kind.

Could you explain what an open testing and integration center, or OTIC, is, in relation to the O-RAN ecosystem, to a novice like me?

Mr. Baker. Yeah. So an OTIC, you know, is set up on the basis of testing the performance of an Open RAN element to a defined specification. So one great example of an OTIC in the U.S. which is Kyrio which is -- CableLabs' Kyrio, where the 5G challenge testing was actually done. And that was actually using O-RAN specifications and testing the performance of the equipment.

Now, you know, did they test to all the parameters of the O-RAN specification? No, they did not, so. But that is an example of an OTIC. They will take your equipment, take your software --

Mr. Weber. And where did you say that is?

Mr. Baker. It is actually CableLabs. It is under Kyrio, which is a CableLabs

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subsidiary in Denver.

Mr. Weber.   In Denver, Colorado.   Okay.

Mr. Baker.   Denver, Colorado.

Mr. Weber.   If an O-RAN network vendor from, let's say for example, Turkiye, wanted to get their network tested, would they be able to bring that to that United States facility, as in, to an OTIC based in another country?

Mr. Baker.   Absolutely, yes.

Mr. Weber.   Are you concerned about that?

Mr. Baker.   No.   Or, you know, getting -- you know, bringing their software essentially, because they are running it on the common hardware.   The common hardware could effectually be sourced in the United States.   So any developer could bring their software code into an OTIC and have it tested.

Mr. Weber.   So you have heard of reverse engineering?

Mr. Baker.   Yes.

Mr. Weber.   But there is no way one of those companies could hack into that to access security data about the network at all?

Mr. Baker.   No.   These are stand-alone isolated test centers where they would just specifically test the -- you know, they have none of the end-to-end network knowledge.   They just have the specific element knowledge.

Mr. Weber.   Anybody else want to weigh in on that?   I mean, is that right?   I mean -- yes, sir?

Mr. Toivo.   So I absolutely agree with Mr. Baker regarding the OTIC.   So TIP has proposed, on top of the OTIC, which is kind of focusing on the interoperability capabilities of those individual O-RAN elements, a system-level certification.

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And the approach with that system-level certification, which is end-to-end capability, that it would be performed in trusted labs and governed by a team that is kind of solely and fully within the realms of the trusted environment -- meaning U.S.-based -- obviously using them labs that could be in the U.S. or could also be with trusted allies in their markets.

Because the whole idea with the certification should be that if you certify once a solution, a configuration, people in other markets should be able to trust that it has been done in a way that it is also applicable for them.

Mr. <u>Weber.</u>   Well, the reason I ask, in your testimony, Mr. Baker, I think you included data from the O-RAN Alliance on page 3.   That illustration at the top of the page -- I got here after your actual testimony, so forgive me, I am a little behind the 8 ball on that.

But my staff found, on your website, an OTIC funded by the CCP -- are you aware of that -- and administered through a number of shell laboratories.   Asia and Pacific OTIC, have you heard of that?

Mr. <u>Baker.</u>   I don't believe there is one in China, but I know there are other OTICs in other parts of the world which are testing product.   And, again, this is -- this is the environment that we live in, that you will see OTICs around the world that will be available to test products.

Now, again, as Mr. Blum said, you know, as a vendor, as a operator, you don't have to use those specific OTICs for doing specific testing for your products.   You will pick the OTIC in the right -- you know, right category in your --

Mr. <u>Weber.</u>   Well, according to my staff, the O-RAN web page says that their parent company, China Mobile, is a founding member of the O-RAN Alliance.   But you

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are not aware of that?

Mr. Baker.   No.   The founding -- certainly China Mobile is a founding company, but personally I am not aware of that specific OTIC.

Mr. Weber.   Okay.

Mr. Baker.   But there are OTICs in the Asia region.

Mr. Weber.   Okay.   Well, I have got a lot longer question than the last one, and they are fixing to call votes, so, Mr. Chairman, I will yield back.

Mr. Latta.   Thank you very much.   The gentleman does yield back the balance of his time.

The chair now recognizes the gentleman from Texas' 11th District for 5 minutes for questions.

Mr. Pfluger.   Thank you, Mr. Chairman.   And I appreciate the opportunity for this hearing, especially in the spirit of competition with the CCP, and so a couple of my questions will be directed at that.   I will start with Mr. Baker.

From my understanding, O-RAN and virtualization will shift more of the network to software-centric solutions where the United States does have a competitive advantage as the world leader in software and Cloud development.

Would Open RAN allow the U.S. to leverage our expertise, and would that help innovation?   Would it help competition?   Does it help security?   If you can expand on that -- I am sure you have already answered some of these questions.

Mr. Baker.   Yeah.   So -- so as I say, Mavenir, you know, in Texas has been working at virtualized software for the last 19 years.   And we are leveraging, you know, all the knowledge that we have gained over those 19 years in virtualization into Open RAN, and we are competing on the world marketplace with first-class virtualized

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solutions that, you know, are leading in the industry.

Mr. Pfluger. Talk to me about security. How does competition, how does innovation, how does leveraging our competitive advantage in that particular space on the software-centric model, how does that help us on the security side?

Mr. Baker. You know, software has got -- is a day-to-day, you know, practice within the organization in terms of software development. We are one of the GSMA-accredited design houses for software security in the GSM Association.

I think, you know, apart from, you know, the big four incumbents, Mavenir is the fifth that was accredited for security and software design and that is -- you know, through external audits and process, that is actually used in the, you know, used within the company.

Mr. Pfluger. Thank you very much.

Mr. Blum, in your experience, are Open RAN network operators coordinating with CISA, the NSA, National Security Council to protect against adversaries that would harm our telecommunications networks? Is that happening?

Mr. Blum. There is close collaboration. I know -- I can speak for DISH and the security agencies, imparting, you know, our learnings and hearing from them. We need to work together with government to learn what is happening on the cyber front, so we then could upgrade our network to deal with it.

We have our network deployed in your district, in Odessa, Midland, and San Angelo right now, Congressman. Visit and see it in action, to see the difference between Open RAN and legacy. And security is evolving, and we need to understand the threats and be able to react to them, and we believe Open RAN is able to effectively do that.

Mr. Pfluger. What do you think the biggest threat is right now that you face and

the biggest challenge that you face?

Mr. <u>Blum.</u>   In terms of general?

Mr. <u>Pfluger.</u>   Yeah.

Mr. <u>Blum.</u>   I mean, I think the biggest challenge is persuading other carriers to adopt Open RAN.   We had a -- you know, we were the first through the gate, and it was hard.   And now to be able to export what DISH and its partners have done to the rest of the world, so we can have more deployments of Open RAN as alternatives to the Chinese vendors, we think is really important.

Mr. <u>Pfluger.</u>   I love the alternatives and I love the competition side of that.

Mr. Toivo, we will go to you, and then I will save 1 minute for Ms. Rinaldo.

How does an organization like Telecom Infra Project promote a trusted supply chain in the components that you are using to help the security theme that we are talking about?

Mr. <u>Toivo.</u>   So first of all, our membership is fully aligned with what is required from the U.S. point of view, so we don't have those members that would constitute any risk.   They really don't have any access to any -- nontrusted vendors don't have any access to our test specifications, our test results, our plan.   So that for me is fundamental, to make sure that our membership is the right one.

Secondly, when we talk about the system-level certification, it is essential that we cover security requirements and we develop in alignment with the industry, in particular the carriers, and necessary government organizations, those specs that these systems need to fulfill.   I think that is the best way to ensure that we start it off in the right way.

Mr. <u>Pfluger.</u>   Thank you very much.

And lastly, Ms. Rinaldo, in your opinion, does the Secure and Trusted

Communications Networks Act protect Open RAN systems from being infiltrated by Chinese technology, CCP entities, or other threats, or must it be updated in the next generation? Talk to us about what steps need to be taken there.

Ms. Rinaldo. Excuse me. I think we all need to take steps to ensure that our legislation continues to get updated to be relevant for whatever threat is facing us at the moment.

I think it is important that we get rip-and-replace done. We have been having this -- I worked for Mike Rogers when we wrote the Huawei report in 2011. It is 13 years later, and we are still having this conversation.

You know, if we can't get the money, let's look at plan B. I think Open RAN offers alternatives.

And then just moving forward, you mentioned intelligence agencies. I think it is incredibly important that our intelligence agencies are able to share information with my member companies about impending threats, and so they can make smart decisions about moving forward.

This is the ultimate public-private partnership what we are talking about. So it has been a great 4 years in running the Coalition, and I appreciate the opportunity for you to hold hearings like this. It does bring a tremendous amount of light into the good things and the things that we can do to keep moving.

Mr. Pfluger. Thank you very much. My time is expired. I appreciate you being here.

Mr. Chairman, I yield back.

Mr. Latta. Thank you very much. The gentleman's time has expired, and seeing no further members seeking to be recognized, I want to thank our witnesses again for

appearing today.

I ask unanimous consent to insert in the record the documents included on the

staff hearing document list.

Without objection, so ordered.

[The information follows:]

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

Mr. <u>Latta.</u>   I remind members they have 10 business days to submit questions for the record, and I ask the witnesses to respond to the questions promptly.   Members should submit their questions by the close of business on Tuesday, January the 30th.

And without objection, the subcommittee is adjourned.

[Whereupon, at 4:37 p.m., the subcommittee was adjourned.]