

Open Radio Access Networks: A Primer for Policymakers

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Open Radio Access Networks (Open RANs) would define open standards and interfaces between components of wireless RANs, providing a unique opportunity to diversify the supply chain by separating today's integrated, single-provider RAN systems into modular parts.

KEY TAKEAWAYS

- Open RAN is a concept that encourages interoperable interfaces among various RAN components (the distributed unit, centralized unit, radio unit, etc.), so a range of vendors can provide components for different parts of the network.
- Open RAN will help telecommunications providers tackle market challenges such as a lack of supplier diversity, a reliance on one specific vendor, and the black-box nature of RAN hardware.
- Open RAN offers an important component of a potential solution that counters growing security concerns associated with Chinese telecom equipment maker Huawei.
- Many questions remain unanswered as Open RAN begins to enter the wireless market. Until answers are clear and unchallenged, policymakers should remain skeptical of throwing all resources toward Open RAN deployment.
- To support the future of Open RAN, the United States needs to support an effective transition to an open and disaggregated wireless infrastructure with continued investment and innovation—not market interference to force a premature transition.

INTRODUCTION

Mobile wireless operators have a relatively limited set of options when purchasing telecommunications equipment, particularly for the radio portion of a network. This equipment, which translates signals between the wired and wireless portions of a network, has traditionally been provided through closed, proprietary systems maintained predominantly by Ericsson, Nokia, or Huawei. This presents a number of long-term challenges to the sector, particularly as Huawei represents a growing security threat.

Open Radio Access Networks (Open RANs) would define open standards and interfaces between components of the RAN, provides a unique opportunity to diversify the supply chain by separating today's integrated, single-provider RAN systems into modular parts that can be sourced from a variety of different vendors. As acting Federal Communications Commission (FCC) Chairwoman Jessica Rosenworcel put it, Open RAN has “emerged as one promising path to drive 5G security and innovation in the United States.”¹ She rightly also noted that “predicting communications technology is a dangerous business ... technology is dynamic, [it] evolves fast.”² Any solution to wireless infrastructure ills will require a diversity of efforts that allow for increased innovation. To maximize the potential benefit of Open RAN, policymakers should let it “develop organically,” enabling research and development (R&D) within the telecommunications community.³

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The telecommunications market is dominated by a relatively small number of players. As a result, security concerns associated with just one or two players have an outsized impact on the telecommunications market at large. Open RAN offers an important component of a potential solution that counters growing security concerns associated with Huawei and other high-risk technology.

Open RAN's ability to expand the telecommunications market—and potentially drive down costs and drive up capabilities—has potential, but policymakers must carefully consider the complexities associated with a transition to Open RAN-compliant components. 5G networks have already been deployed across the country, while Open RAN-compliant components are not yet widely deployed.⁴ It may take until the deployment of 6G for the use of Open RAN to be fully commonplace. Policymakers should ensure policies are developed with flexibility in mind to match the natural evolution of the wireless infrastructure market.

WHY OPEN RAN?

There are many reasons wireless operators are interested in exploring more modular radio access equipment. One reason is cost. Some estimates place RAN costs as up to 60 percent of the total cost—both opex and capex—of owning a network.⁵ This evolution in architecture also opens tremendous opportunities for innovation. Open, commonly defined interfaces allow multiple firms to innovate along narrow specialties and help ease the transition of some functionalities to software running on general-purpose hardware.

A more flexible architecture would reduce dependence on a narrow set of suppliers and ease the long-term risk of market consolidation around Chinese actors—especially Huawei and ZTE—that benefit from unfair support from the Chinese government.⁶

Concerns regarding the security of Chinese telecommunications equipment providers are not new. In 2012, the U.S. House of Representatives Permanent Select Committee on Intelligence released a report highlighting that “China has the means, opportunity, and motive to use telecommunications companies for malicious purposes.”⁷ The report further indicates that the risks associated with Chinese telecommunications companies cannot be completely mitigated and that “Huawei and ZTE cannot be trusted to be free of foreign state influence.”⁸ More recently, allegations of security vulnerabilities have been compounded by China’s national security laws and the rapid growth of China’s telecommunications companies.⁹

As wireless technology proliferates around the globe, the number of telecommunications equipment vendors shrinks, making the risk of insecure technologies more apparent.¹⁰ Huawei and ZTE’s “substantial ties to the Chinese government ... known cybersecurity risks and vulnerabilities in their equipment, and ongoing Congressional and Executive Branch concern about this equipment,” led them to be designated as a threat to national security by the FCC.¹¹ A growing market, shrinking supply chain vendor list, and the expansion of propriety and noninteroperable technologies have generated the conditions for the evolution of Open RAN. Leveraging Open RAN, telecommunications providers could reduce the scope and scale of Chinese control over critical infrastructure while simultaneously diversifying their supply chains.

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Even without the China challenge, policymakers should design policies that do not inadvertently discriminate against Open RAN, as the benefits to wireless quality and cost could be significant.

WHAT IS OPEN RAN?

Open RAN is a concept that encourages interoperable interfaces among the various RAN components (the distributed unit, centralized unit, radio unit, etc.).¹² Open interfaces allow a range of vendors to provide components to build different parts of the RAN. The market has been dominated by just a few vendors that offer propriety technology that requires one single vendor to provide all the RAN components. With Open RAN, however, telecommunications network deployers can assemble elements from different vendors to build the RAN (assuming the vendors offer Open RAN-compliant products).

Open RAN developments have been championed by the O-RAN Alliance and the Telecom Infra Project (TIP).¹³ The O-RAN Alliance, based in Germany, is led by telecommunications companies, ranging from AT&T to China Mobile.¹⁴ TIP, a Facebook-initiated endeavor, counts hundreds of participants in its ranks.¹⁵ Outside the O-RAN Alliance and TIP, Open RAN is promoted formally by the Open RAN Policy Coalition, which similarly has a range of global telecommunications-related members.¹⁶

OPEN RAN HAS POTENTIAL

Open RAN will help telecommunications providers tackle certain existing market challenges, such as a lack of supplier diversity, a reliance on one specific vendor, and the black-box nature of RAN hardware.¹⁷ At present, the major RAN suppliers are consolidated, with only a few international players responsible for the vast majority of telecommunications infrastructure. If a network operator needs to replace a component or upgrade the RAN, or has discovered a vulnerability, the network operator is reliant on the original vendor. This singular reliance on one specific vendor creates a host of possible problems. Adopting Open RAN-compliant standards, however, will increase the number of competitors in the RAN marketplace, allowing for diversification of RAN components within one system.

Encouraging open interfaces may help generate increased innovation, as more vendors are able to participate in the market and specialize in specific components without requiring the development of an entire RAN system. Increased innovation may help increase network security as vendor competition increases.¹⁸ As Open RAN-compliant vendors offer interoperable components, they will likely seek new ways to differentiate themselves in the marketplace, with security strength being one such avenue.

Increased competition and specialization may also help decrease prices, as vendors become more able to focus on optimizing their specialized components. Innovation may further allow for increased virtualization on generic hardware.¹⁹ As hardware functions become performed by software, repair costs may go down as operators reduce their requirement for direct manual labor to address each individual repair across a large network. Operators and their respective vendors can instead rely on software upgrades and patches to address various issues.

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The open interfaces will further allow operators increased visibility into the RAN components within their network. Increased interoperability and virtualization will allow network operators to better track and manage disruptions that occur at different points in the RAN pathway.²⁰ Enhanced network awareness will further allow network operators to better ensure efficiency and optimize network performance.

OPEN RAN WILL NOT SOLVE ALL 5G NETWORK TROUBLES

There is a mix of opinions regarding the security of Open RAN and whether it will strengthen the security of the RAN infrastructure. Some highlight the fact that the “disaggregated and multivendor nature of Open RAN expands the threat and attack surface of the network in numerous ways.”²¹ By leveraging Open RAN, industry will move away from acute security supply chain issues toward a broader attack surface with a more-difficult-to-control supply chain. By introducing a multitude of vendors, all with different technological components, network operators will need to manage a complex and integrated network.²² An operator may now need to verify the supply source of five different vendors instead of one and be reliant on the transparency and expediency of five vendors, some of which may have modest operations and a reduced ability to ensure high levels of security.

However, others point to Open RAN as a way to strengthen our telecommunications infrastructure, and claim, “It is a misconception that disaggregation of the RAN increases the attack surface.”²³ With Open RAN compliance, network operators are able to pick and choose between different vendors that may have different strengths across a range of RAN components. It may also encourage increased transparency across vendors to ensure interoperability and heightened innovation. Even so, Open RAN will not halt the use of various components from countries with different security and privacy considerations that could still be integrated into the RAN infrastructure and present unique network vulnerabilities.²⁴

Moreover, Open RAN’s energy efficiency is still debated. Some argue Open RAN will increase power consumption by 40 percent%, whereas others argue its energy consumption will be competitive.²⁵ The efficiency of Open RAN systems will take time to discover and therefore cannot be guaranteed.

Many questions remain unanswered as Open RAN standards and compliant technology begin to enter the wireless market. Industry and relevant stakeholders will likely continue to research the answers to these critical questions regarding security and efficiency. But until the responses are clear and unchallenged, policymakers should remain skeptical of throwing *all* resources toward the deployment of Open RAN.

HOW TO SUPPORT OPEN RAN

Efforts to advance Open RAN will likely be complicated, as competing demands and different ideologies delay the expeditious passage of legislation. Technology policy proposals are often a balancing act between those who want to limit government intervention, those who favor increased regulation, and those who are primarily concerned with innovation.²⁶ The U.S. Senate passed the U.S. Innovation and Competition Act, which encourages the development of Open RAN testbeds and appropriates \$1.5 billion to the Public Wireless Supply Chain Innovation Fund to help fund open architecture.²⁷ However, the U.S. House of Representatives has yet to pass similar legislation. Recent House requests for appropriations for the Public Wireless Supply Chain Innovation were for \$750 million, half the current proposal on the Senate side.²⁸ Moving from a closed infrastructure to open and modular architecture will be complex, but there are policies in place that could help get the U.S. market to that future—and funding is a critical component.

To support the future of Open RAN, the United States needs to right-size the policy to support an effective transition to an open and disaggregated wireless infrastructure. The U.S. government should support continued investment and innovation around Open RAN, but it should not interfere in the marketplace to force a premature transition. The FCC, along with other government entities, could facilitate the evolution and deployment of Open RAN by supporting research and testbeds, and ensuring policies and regulations enable innovation and adoption.²⁹ As outlined in President Biden’s Executive Order on promoting competition, the FCC should support development and adoption of 5G Open RAN protocols and software.³⁰ In doing so, the FCC could convene relevant stakeholders and key experts to help identify potential challenges to the Open RAN standards and enable mitigation efforts.

U.S. policymakers, however, do not need to enforce technology mandates, nor should they require the use of Open RAN in response to the rip-and-replace mandate.³¹ Overly zealous efforts

to capitalize on the newest tool in the 5G infrastructure tool kit may not make sense in all instances, whether due to expenses or associated timelines that would prohibit expeditious replacement. Policymakers should trust industry experts with on-the-ground experience with their unique networks to make the appropriate decision for when Open RAN components make sense during a network restructuring.

Finally, policymakers should not be afraid to enact robust industrial policy to support these critical industries.³² The Chinese government has substantially enabled Huawei and ZTE.³³ U.S. policymakers should consider methods to fairly enable competition within the RAN marketplace, by encouraging research and dismantling barriers to development and deployment. Government and industry should work together to lower costs and ensure security. At the same time, policymakers should consider the implications of 5G-related decisions and the potential springboard (or barrier) they might create for future generations of wireless technology. Tapping into existing expertise in both the government and industry, policymakers can enable innovation to help ensure the United States maintains its competitive advantage.

The U.S. government should support continued investment and innovation around Open RAN, but it should not interfere in the marketplace to force a premature transition.

CONCLUSION

Open RAN shows promise, but policymakers should not abandon all lessons learned during previous iterations of wireless technology development to solely pursue what is but one component of the solution to U.S. wireless technology concerns. It will not completely counter unfair practices in the marketplace or automatically restore U.S. equipment leadership. Open RAN is not (at this time) more or less secure than other RAN infrastructures, nor will allowing an influx of competition automatically ensure increased innovation.

Policymakers should support Open RAN R&D and enable adoption while allowing market decisions to be based on carrier choices.³⁴ As the Information Technology and Innovation Foundation (ITIF) has written, “The strength of the U.S. system is its dynamic, competitive market where firms are free to experiment with different partners and technologies.”³⁵ The nascent evolution of Open RAN and its real-time application are promising, but much remains to be seen in terms of timeline, feasibility, and scale of deployment. Policymakers should play to the United States’ known strengths and enable new technology but not dictate its adoption. Pursuing a balanced approach, policymakers could help ensure the United States remains competitive in the wireless markets of both today and the future. Policymakers should encourage the development and growth of Open RAN-compliant systems, but should avoid putting the cart in front of the horse.

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About ITIF

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ENDNOTES

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