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THE CASE FOR U.S. LEADERSHIP IN TRUSTED 5G INFRASTRUCTURE

**MITRE'S MULTI-DISCIPLINARY ASSESSMENT
OF THE GLOBAL 5G INFRASTRUCTURE MARKET**

by Christine Gilbert, Jim Houchens, Christopher Moeller, Arman Mozahebi, and Maggie Vencill

The U.S. must play a leadership role in 5G and beyond communication technology to protect the security and integrity of the future national telecommunications backbone.

To accomplish this, the U.S. must accelerate the nationwide roll-out of 5G by encouraging the adoption of 5G Open RAN infrastructure, incentivizing U.S.-based 5G component manufacturing, and enticing U.S.-based companies to enter the 5G market.

EXECUTIVE SUMMARY

In the global market for 5G infrastructure components, government regulation can prevent the use of equipment developed by or imported from adversarial nations within the U.S. telecommunications structure but regulations do not ensure that the private sector can offer economically feasible alternatives. This requires a healthy, diverse technology ecosystem that can innovate and achieve economies of scale at a competitive price. Unfortunately, the current provision of 5G Radio Access Network (RAN) on proprietary end-to-end (E2E) integrated systems imposes higher manufacturing costs and requires specialized cross-disciplinary skills. These barriers to entry inhibit U.S. companies from entering the 5G market, let alone establishing a leadership position in it.

The needed disruptor that is emerging is Open RAN—a new set of specifications that disaggregates the RAN into a set of interoperable components. The Open RAN architecture, with standardized interfaces between RAN components, facilitates interoperability and reduces barriers to entry, by enabling innovators to focus on those components where they have the greatest competence. By fostering the emergence of new entrants into the commercial marketplace, creating greater competition, and reducing the need for specialized components, U.S. industry can produce economically viable and trusted alternatives more quickly and at scale. Current U.S. Open RAN offerings are not mature enough to attract sufficient worldwide market share. Early adoption and targeted investment from the U.S. government and industry will provide a defined path for Open RAN to restore U.S. leadership in the global 5G infrastructure market.

This paper reflects MITRE's multi-disciplinary assessment of the global 5G infrastructure market and specifically the RAN/Open-RAN sub-segment. MITRE found that, to foster the conditions favorable to a diverse U.S. 5G ecosystem and domestic market, the U.S. government must:

- Incentivize Open RAN companies to mature and expand the Open RAN market in the United States
- Subsidize U.S.-based manufacturing of 5G infrastructure (in particular, Open RAN) components
- Entice existing U.S.-based companies to enter the market as integrators until the market matures and norms eliminate the need for integrators

MITRE also developed a set of criteria to evaluate private firms capable of entering the market as 5G infrastructure integrators. The paper outlines the U.S. government levers of power and potential actions to create a marketplace favorable to government-supported partnerships. The government can leverage the Power and Preference methodology presented in this paper to assess private U.S. companies for their potential to partner with the government in this important undertaking.

INTRODUCTION AND BACKGROUND

The United States must play a leadership role in fifth-generation (5G) and beyond communications technology, to protect the security and integrity of the future national telecommunications backbone. 5G technology connects vital functions and serves as the backbone of smart cities, Industry 4.0,¹ autonomy, virtual and augmented reality, and new industries not yet envisioned. A 2017 Technology Review study commissioned by Qualcomm and MIT² highlights the importance of 5G technology for the global economy and forecasts that by 2035, 5G's contribution to global gross domestic product will approximate \$2.94 trillion. The United States must accelerate the nationwide roll-out of 5G so that U.S. entrepreneurs have the infrastructure that allows them to deliver innovation at scale and capitalize on the revenue generation opportunities at home and abroad.

Apart from making the necessary spectrum available to U.S. mobile carriers and reducing regulatory hurdles that slow or prevent building new cell sites, U.S. carriers must have access to trusted equipment that meets the highest standards in terms of features, quality, and price. While the government can take actions to ban equipment developed by or imported from adversarial nations, the private sector must offer economically feasible alternatives. This requires a healthy, diverse technology ecosystem that can innovate and achieve economies of scale at a competitive price so the United States does not find itself yet again in a consolidated infrastructure market lacking supply chain diversity. The United States must regain influence over the standards that define these networks, to ensure they meet the needs of our nation and to prevent any one nation from gaining the upper hand in giving its indigenous companies advantages through the standards process.³

Some components of the 5G infrastructure already play to U.S. strengths. The Core⁴ has migrated from specialized telecommunications protocols and hardware to internet protocols running in virtualized software containers hosted on standard enterprise-grade servers and networks. This has led to the emergence of new U.S. players in the 5G market. Unfortunately, certain components of 5G infrastructure, such as the 5G Radio Access Network (RAN), which is key to leadership

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CURRENT U.S. OPEN RAN OFFERINGS ARE NOT MATURE ENOUGH TO ATTRACT SUFFICIENT WORLDWIDE MARKET SHARE, BUT WITH TARGETED INVESTMENT FROM THE U.S. GOVERNMENT AND INDUSTRY, OPEN RAN COULD PROVIDE A DEFINED PATH TO U.S. LEADERSHIP IN THE 5G GLOBAL INFRASTRUCTURE MARKET.

in this area, continue to be hosted on proprietary end-to-end (E2E) integrated systems that impose higher manufacturing costs and require specialized cross-disciplinary skills.

Today, China's Huawei has a significant lead in 5G offerings, as the company benefits from privileged status as an enterprise backed by the Chinese government.

Taking over the lead from Huawei will require a disruptive approach that plays to the strengths of the U.S. private sector, such as leadership in cloud solutions and software development, virtualization, orchestration of service-oriented architectures network functions, and the design of commodity enterprise computing and networking components such as routers, switches, and servers. The disruptor emerging is Open RAN—a new set of specifications that disaggregates the RAN into a set of interoperable components. This new architecture allows a significant portion of the RAN to be moved to a cloud architecture that runs in software containers hosted on commodity hardware. The Open RAN architecture, with standardized interfaces between RAN components, also facilitates interoperability and reduces barriers to entry, by enabling innovators to focus on those components where they have the greatest competence. By fostering the emergence of new entrants into the commercial marketplace, creating greater competition and reducing the need for specialized components, U.S. industry can produce economically viable and trusted alternatives more quickly and at scale, positioning the U.S. for leadership in 5G and beyond.

Current U.S. Open RAN offerings are not mature enough to attract sufficient worldwide market share, but with targeted investment from the U.S. government and industry, Open RAN could provide a defined path to U.S. leadership in the 5G global infrastructure market. Integration of Open RAN will likely face greater deployment challenges into existing systems than in greenfield deployments. Given that many current 5G deployments are leveraging existing LTE infrastructure, Open RAN has an intrinsic barrier to overcome in some cases before it can fully penetrate the market.

Due to the current U.S. dependence on foreign E2E integrated providers, establishing the path to U.S. 5G leadership will take time,

resources, and considerable commitment across industry, government, and academia, in a whole-of-nation effort. It will also require urgent action to take advantage of the opportunities that Open RAN presents.

This paper reflects MITRE's multi-disciplinary assessment of the global 5G infrastructure market, and specifically the RAN/Open-RAN sub-segment. It outlines the U.S. government levers of power and potential actions to cultivate a marketplace favorable to attract government-supported partnerships.⁵ The government can leverage the Power and Preference methodology presented in this paper to assess potential support for partnerships with private industry.

ANALYSIS OF THE 5G MARKET

The recommendations at the end of this paper derive from MITRE's market and competitive analysis and aim at moving companies in the Low Power/High Preference quadrant to the High Power/High Preference quadrant and retaining the companies in the latter quadrant and preventing them from moving to Low Power or Low Preference quadrants. Each recommendation is broken into several specific strategies and actions for the U.S. government.

MITRE found that juxtaposing the scores in each quadrant produced a four-quadrant view of potential partners (see Figure 1) that translates to tailored partnering strategies. This approach would be helpful for U.S. decision makers as they establish partnering strategies to support U.S. leadership in 5G.

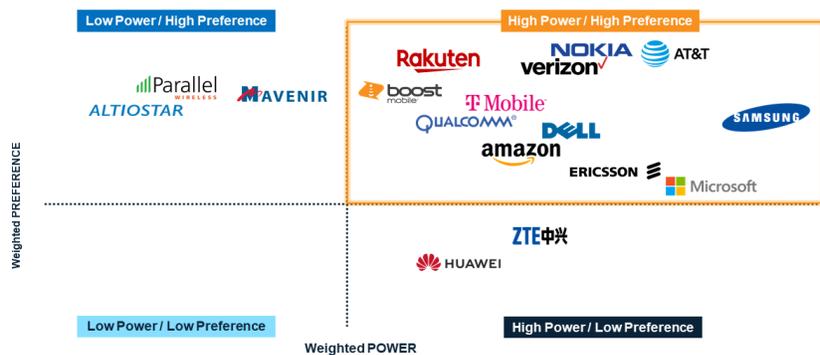


FIGURE 1. POTENTIAL 5G PARTNERS

Open RAN fosters horizontal openness—making hardware and software independent of each other and enabling functions of the RAN to connect with other functions. For example, the Radio Unit (RU) can consist of commercial off-the-shelf (COTS) hardware obtainable from any vendor. Open RAN has also standardized an open interface between the Baseband Unit (BBU) and RU, so that any software supplier can work in Open RAN environment. It has the further potential of bringing the automation associated with cloud operating models to the RAN.

Figure 2 describes the components that will be vendor-agnostic and the ones likely to remain proprietary.

	Base Station	Radio Access Network				
Traditional RAN	Traditional Base Station	Proprietary Hardware Radio Unit (RU) + Baseband Unit (BBU)			Backhaul	Core Network
	<ul style="list-style-type: none"> ▪ Signal Processing ▪ RF Equipment ▪ Network Access ▪ RF Cable 					
Software Defined	Contemporary Base Station	Proprietary Hardware Radio Unit (RU)	Proprietary Interface	Proprietary Hardware Radio Unit (RU) + Baseband Unit (BBU)	Backhaul	Core Network
	<ul style="list-style-type: none"> ▪ Signal Processing ▪ Fiber Connection 					
Open RAN	Open RAN	COTS Hardware RRU (Any Vendor)	Standardized Front Haul	COTS Cloud-based DU/CU (Any Vendor) Midhaul	Backhaul	Core Network

In a 5G RAN architecture, the Baseband Unit (BBU) functionally is split into two functional units; a distributed unit (DU), and a centralized unit (CU)

FIGURE 2. RAN VS. OPEN RAN VENDOR-AGNOSTIC AND PROPRIETARY COMPONENTS

As Open RAN evolves from promise to reality, the Open RAN market will mature by capitalizing on U.S. technical prominence in areas such as software development, cloud services, and mobile edge computing, thereby providing an opportunity for the emergence of U.S.-based leadership in 5G infrastructure.

While there are growing efforts to help telecommunications networks use COTS hardware for 5G, the nation has realized only a small part of Open RAN’s market potential. The dynamics between price, quality, and interoperability remain unknown.

Dish Network (Dish), a recent addition to the telecommunications market through Boost Mobile, is the fourth largest wireless carrier in the United States. Dish is unique because it strives to be a strategic market disruptor and has recognized Open RAN as an opportunity to drive and

IN GENERAL, OPEN RAN CONFLICTS WITH TRADITIONAL INFRASTRUCTURE TELECOM COMPANY STRATEGIES. U.S. WIRELESS CARRIERS STRIVE TO PROTECT AND BUILD THEIR CUSTOMER BASE. OVERCOMING THE RISK OF LOSING CUSTOMER BASE MUST BE A PRIORITY TO BUILD CONSENSUS ON OPEN RAN INTEGRATION.

achieve its market strategy. The company therefore decided to follow an Open RAN strategy and selected Fujitsu and Altiostar as suppliers and partners for its 5G Open RAN network. In addition, Dish selected Nokia for its cloud-native, standalone core software products. Dish represents a minority among U.S. telecoms adopting and integrating Open RAN. If Dish successfully deploys the Open RAN network, it is likely other U.S. and international carriers will likely follow. Due to their unique position as a greenfield deployment, Dish will be the first network provider that builds on fully Open RAN infrastructure.

Open RAN conflicts with traditional infrastructure telecom company strategies. U.S. wireless carriers strive to protect and build their customer base. Overcoming the risk of losing customer base must be a priority to build consensus on Open RAN integration. Laurie Bigler, Assistant Vice President at AT&T Labs, recently stated, “The challenge for an operator like AT&T, really, like any other network architecture is ensuring the reliability, integrity, and performance to our customers. The key consideration will be whether we continue to achieve the same level of performance at scale.”⁶

U.S. deployment of 5G infrastructure is currently limited to dense urban areas (where the density of customers per geographic area can profitably support the high costs of 5G equipment). Because Open RAN is more cloud-based and virtualized, in general, it is easier and less expensive to deploy and maintain, although it is spectrum-use dependent. This lower price point makes expansion of 5G into suburban areas economically viable.

Currently, most RAN equipment used around the world is imported from Europe and Asia after being manufactured in China and/or assembled with Chinese parts. According to Citi analysts,⁷ China represented about 45 percent of Ericsson’s “manufacturing-facility area” last year and 10 percent of Nokia’s. The few U.S.-based RAN vendors focus mainly on innovative new virtualization techniques and do not have large-scale manufacturing capabilities. While Open RAN will move a greater portion of the RAN to software functions running on commodity hardware, certain components, such as the RUs and active antenna elements, cannot be virtualized.

Ericsson (Sweden), Nokia (Finland), Huawei (China), and Samsung (South Korea) are the current market leaders in the 5G infrastructure market. Their continued investments in research and development (R&D), along with their significant installed equipment base and market share, create barriers to market entry that have dissuaded new U.S.-based companies from entering the market, much less trying to capture a leadership position in it.

Market leader E2E providers are currently the only options for fostering market integration, and to date they integrate mostly equipment they manufacture themselves. As Open RAN evolves, a new market will emerge as integrators create alternatives to traditional offerings and solutions connecting the ecosystem of equipment manufacturers, software providers, and carriers. This is another area that would play to U.S. strengths in the defense industrial base.

MITRE evaluated likely U.S. competitors that could be well-positioned to enter the market against both critical business criteria and technical characteristics (see Figure 3).

AS OPEN RAN EVOLVES, A NEW MARKET WILL EMERGE AS INTEGRATORS CREATE ALTERNATIVES TO TRADITIONAL OFFERINGS AND SOLUTIONS CONNECTING THE ECOSYSTEM OF EQUIPMENT MANUFACTURERS, SOFTWARE PROVIDERS, AND CARRIERS.

Business Characteristics

- A. Business: requires to be well funded and capitalized
- B. Fully Integrated, Globally Enabled Provider
- C. End-to-end (E2E) Architecture
- D. Software Expertise: at all levels below
- E. Global Competitiveness

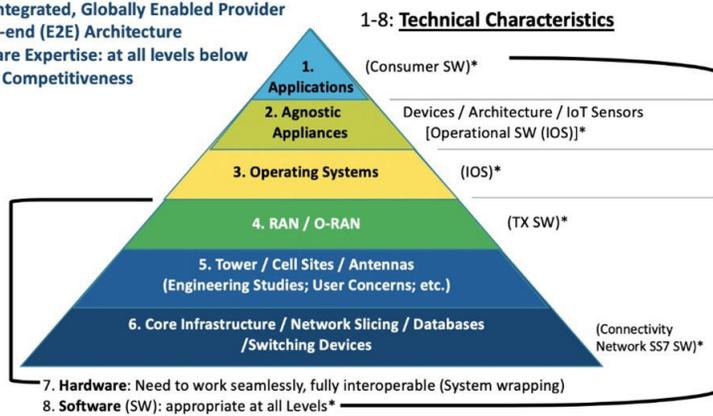


FIGURE 3. 5G MOBILE TELEPHONY OPERATOR BUSINESS CHARACTERISTICS

In view of the promise of and the trends toward Open RAN, the optimal path to establishing a U.S.-based leader in the 5G infrastructure is as an Open RAN integrator. Open RAN promotes compatibility and vendor-agnostic solutions for consumers, which has the added benefit of increasing market diversity. The expansion of 5G with an Open RAN solution and U.S.-based manufacturing capability would likely create significant disruption in the marketplace, providing an opportunity for differentiated solutions from new and innovative U.S.-based market entrants. Those solutions must be integrated into a seamless package, to be competitive with the existing proprietary E2E offerings and be done at scale.

The business characteristics for serving as a market integrator are those enabling competitive participation in a global marketplace, including sufficient capital, access to all the technologies required to deliver 5G services, and the ability to develop essential software, all under the umbrella of an enterprise capable of operating in any national market.

The 5G Mobile Telephony Operator Business Characteristics, introduced in Figure 3, build on a foundation of state-of-the-art system software that reflects the consensus 5G standards evolved by the 3rd Generation Partnership Project (3GPP)⁸ and other cellular standards bodies. They also include capacity in the hardware environment to support each of the system operational layers. Both hardware and software are essential to the six higher levels, namely:

- Backplane comprising network infrastructure
- Cell siting and antenna services
- Critical radio layer “RAN”
- Implementing 5G network operating systems
- Appliances—both telephony and Internet of Things and Industrial Internet of Things
- Device applications, including core voice and data messaging, imaging, and Positioning, Navigation and Timing—which encompasses GPS, motion/location detection, and hundreds of thousands of consumer market “apps”

The following recommendations below derive from MITRE’s analysis of the 5G market, and specifically of the RAN/Open RAN segments. Each recommendation is broken into several specific strategies and actions for the U.S. government.

RECOMMENDATIONS

Incentivize Open RAN companies to mature and expand the Open RAN market in the United States

The introduction of open-source offerings for 5G infrastructure creates a unique opportunity for the United States to build a diverse market for secure 5G offerings. Overcoming the inertia of the existing telecommunications providers to experiment with any solution other than the traditional market-leading E2E providers presents a challenge, but the U.S. government can accelerate the establishment and maturity of the Open RAN market through:

Direct acquisition: The government acts as the first customer for the new Open RAN offering. Global deployment and acceptance of Open RAN requires a significant signal to the global telecommunications market. The United States can take the lead through direct funding of Open RAN efforts. By leading U.S. acquisition of Open RAN infrastructure and capabilities, the U.S. government can establish a first customer testbed for Open RAN, and an opportunity to demonstrate confidence and trust in and U.S. commitment to Open RAN that may attract and incentivize other nations to follow.

The U.S. government can follow the strategies recommended in June 2020 to the National Telecommunications and Information Administration (NTIA) by the Open RAN Policy Coalition:⁹

- The Department of Defense (DoD) and other agencies could use their procurement authorities to promote interoperable RAN through 5G testbeds with the National Spectrum Consortium and deploy the testbeds, which reflects a low risk investment.
- The United States could establish a global innovation fund to promote R&D on interoperable wireless technologies. The FY21 NDAA NTIA Open RAN grant program should be fully funded.¹⁰
- The U.S. Government and industry could co-sponsor a study with major 5G market players on low-risk market impact from RAN to Open RAN, which should include cost/benefit analysis for Open RAN across the different population density morphologies in the United States.

Incentives to Mature the Open RAN Market: The government provides incentives to mature market offerings and enable industry partnerships. U.S. and foreign telecommunications players continue to view Open RAN as presenting both a promise and a risk. Direct funding of projects involving Open RAN led by the United States might furnish grounds for U.S. suppliers to believe in the potential of Open RAN, but that will not suffice. The United States must incentivize domestic and foreign companies to partner, invest in, and deploy Open RAN at scale across the globe.

- The government could provide R&D tax credits to companies showing commitment to interoperable technology.
- The government could invest in supportive structures that lower barriers to entry and encourage transformative business. It is important that the government take on the risk and open the door to smaller companies to participate in testbeds and incubation programs and help them continuously innovate to improve their position in the marketplace.
- The government could incentivize private, public, and academic engagement in standards-development organizations to promote interoperable standards (i.e., revised tax policy to write off foreign travel, to attend standards-engagement meetings and conferences).¹¹

Bipartisan support for Open RAN is increasing in the United States. While it might seem that larger and more established vendors in the RAN space would be wary of the new deployment option, both Nokia and Ericsson are members of the ORAN Alliance¹² and support interoperability.

As described in the section on *Analysis of the 5G Market*, U.S. companies including Parallel, Mavenir, and AltioStar/Dell compose the principal players and potential suitors for U.S. government partnership in Open RAN area.

Subsidize U.S.-based manufacturing of 5G infrastructure components

Private firms have an opportunity to partner with existing competitors (see the section on Analysis of the 5G Market) to entice them to move increasingly larger percentages of parts manufacturing and assembling away from Asia to the United States and our closest partners and allies. The government can leverage increasing U.S.-based manufacturing through two approaches.

Establish U.S. government/industry partnerships: Establish partnerships to increase domestic design and manufacturing capacity. Open RAN startups are currently procuring RUs from E2E vendors such as Nokia and Ericsson. The RU component of 5G represents a strong opportunity to bring manufacturing to the United States because of the market demand for these products. Shifting manufacturing stateside would provide U.S. Open RAN companies with an ability to access domestically produced components and expand their R&D efforts. U.S.-made components could also mitigate security concerns and backdoor vulnerabilities that emanate from reliance on foreign manufacturers and would create jobs.

The realization of a domestic manufacturing base would depend heavily on support and funding by the U.S. government. Existing legislative and policy proposals may serve as the foundation to accelerate U.S. government strategic partnerships to establish domestic 5G manufacturing capabilities and capacity.**

The Federal Communications Commission (FCC) established and funded a \$20 billion Rural Digital Opportunity Fund, and the U.S. House Energy and Commerce Committee funded a \$40 billion LIFT America Act, for a total 5G investment package of \$60 billion.

Using the funding provided by the FCC and Congress, the U.S. government could use proven approaches to support U.S.-based manufacturing,¹³ such as:

- Granting tax incentives for establishment of factories and job creation.
- Investing directly either through U.S. government-directed purchasing or factory construction.

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- Requiring domestic manufacturing as a condition of foreign companies' access to the U.S. market.
- Incentivizing U.S. carriers to deploy 5G across America and extend beyond dense urban areas to suburban and rural areas (see Recommendation #2). This will allow for a new set of use cases to be developed and tested and for businesses supporting the 5G infrastructure to expand.
- Incentivizing U.S. companies to acquire an existing foreign E2E 5G provider or establish a legal base in the United States for foreign companies to receive incentives/benefits. The U.S. government could create an exception or precedent that allows for greater incentives to non-U.S. companies (above and beyond extending lines of credit at favorable terms) in areas critical to national security.

Buy USA: Promote procurement of U.S.-designed and -manufactured infrastructure. The U.S. government has recognized the risk of globalizing the supply chain, specifically related to advanced U.S. technology and defense systems. The effort to eliminate dependencies on foreign sources and the potential for single points of failure along the supply chain creates an opening for U.S.-based sources of supply, reliable domestic manufacturing, and onshoring of supply chains.

To support U.S.-based manufacturing, the U.S. government can take steps to make procuring these products more attractive. The government has already banned federal funding of Huawei and ZTE components in the U.S. telecommunications system. This represents a significant action to curtail both foreign supply chain dependencies and security risks for telecommunication components.

The CARES Act (or similar subsequent legislation) and Defense Production Act (DPA) provide opportunities for businesses to obtain federal funding to create domestic industrial base capabilities and supply chains. The U.S. International Development Finance Corporation (DFC) is the delegated agency administering the funding for the CARES Act and DPA.

The DFC operates a \$60 billion budget and intends to allocate resources to incentivize U.S. and U.S.-friendly nations to purchase 5G infrastructure, equipment, and hardware from non-China suppliers.

- There can be more subsidies for “rip and replace” (referring to replacing China-made infrastructure with U.S.-made infrastructure).
- Guaranteed U.S. government purchasing (DoD and other government agencies).
- Tax incentives to telecommunications companies that prioritize U.S.-made equipment.
- Financial incentives in future spectrum auctions, on the condition that U.S. wireless providers (Verizon, T-Mobile, AT&T) purchase infrastructure designed and manufactured in the United States.

Companies aligned with the U.S. government’s strategy include Ericsson and Nokia (Nokia is currently providing equipment for Open RAN projects in the United States and abroad). The U.S. government actively courted Ericsson and Nokia to bring manufacturing capabilities and operations to the United States; Ericsson’s first smart factory in the United States is now operational in Lewisville, Texas and producing 5G base stations to enable rapid 5G deployments.

As the United States initiates efforts through legislation to onshore 5G infrastructure manufacturing, the U.S. government should anticipate and consider China’s response and challenges. Beijing will undoubtedly counter with its own attempts to induce potential U.S. partners to stay with China’s market through subsidies or threats of retaliation such as barring U.S. companies from competing in the Chinese market.

AS THE UNITED STATES INITIATES EFFORTS THROUGH LEGISLATION¹⁴ TO ONSHORE 5G INFRASTRUCTURE MANUFACTURING, THE U.S. GOVERNMENT SHOULD ANTICIPATE AND CONSIDER CHINA’S RESPONSE AND CHALLENGES.

Entice existing U.S.-based competitors to enter the market as integrators

Several of the likely competitors covered in the MITRE assessment could be highly viable as new Open RAN integrators. A complementary U.S.-based manufacturing capability (see Recommendation #2) and an increase in market demand from an expansion of U.S. 5G coverage to the suburbs and rural areas with Open RAN (see Recommendation #1) could overcome the hesitation current U.S.-based competitors have expressed. Successful Open RAN deployment and growth depend on software solutions and virtualization capabilities—already strengths of U.S. industry and potential entities under consideration as partners that align with the U.S. 5G strategy. Successful Open RAN must also build on component integration and interoperability. The U.S. government could:

- Promote standards that enable interoperability to reduce cost and complexity of creating heterogeneous network components and ensure sufficient handover performance between different RAN and Open RAN builds
- Entice industry to establish a conformity assessment regime based on the above standards
- Promote NIST/NTIA as champions of efforts directly with industry to establish an underwriter's lab as a scientific testing environment for Open RAN software
- Establish a public-private partnership dedicated to promoting and Drive R&D investments in plug-and-play component solutions

The United States would need to balance between partnering with current global leaders such as Nokia and Ericsson and the eventual desire to increase market diversity with a U.S.-based leader. Open RAN's vendor-agnostic approach would provide a path for participation by traditional RAN players. As a result, both Nokia and Ericsson are strategically positioning themselves to take advantage of the U.S. demand and of the potential global demand for Open RAN.

CONCLUSION

The United States can secure 5G leadership. Current market conditions offer a unique chance for the nation to capitalize on its strengths and grow domestic 5G leaders that can challenge Huawei and participate in the coalition of like-minded allies the State Department is building.¹⁵ The path to cultivating U.S. 5G market leaders involves commitment to fostering the budding Open RAN market and expanding the U.S.-based manufacturing capability. Both of these developments will also naturally increase market diversity in the United States and abroad.

The U.S. government has a critical opportunity to influence and capitalize on the global 5G market shift and cultivate domestic 5G integrators as global leaders offering secure options for telecommunications equipment made in the United States. It can do this while accelerating market diversity with an open-sourced approach to 5G infrastructure. A methodical approach to partnerships with current market competitors that are willing and able to support U.S. leadership in 5G and applying objective criteria to investment and policy decisions would enable this shift.

Endnotes

- 1 The Fourth Industrial Revolution (or Industry 4.0) is the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology.
- 2 <https://www.technologyreview.com/2017/03/01/153487/the-5g-economy-how-5g-will-impact-global-industries-the-economy-and-you/>
- 3 Please see MITRE White Paper from February 2021, [Securing Western Leadership in Global 5G Standards and Patents \(mitre.org\)](#)
- 4 <https://5g.systemsapproach.org/arch.html>
- 5 Laurie Bigler comments at FCC Forum on 5G Open Radio Access Networks, 14 September 2020
- 6 Laurie Bigler comments at FCC Forum on 5G Open Radio Access Networks, 14 September 2020
- 7 [China May Retaliate Against Nokia and Ericsson If EU Countries Move to Ban Huawei - WSJ](#)
- 8 3GPP is a consortium of market leaders that includes seven regional standards development organizations and manages and defines the international standards for 5G development. This has led to carriers falling uniformly in line under the leadership of 3GPP.
- 9 <https://www.openranpolicy.org/wp-content/uploads/2020/06/Open-RAN-Policy-Coalition-Comment-for-National-Strategy-for-Secure-5G-6.25.2020-as-filed.pdf>
- 10 Sec 9202, H.R.6395 - National Defense Authorization Act for Fiscal Year, <https://www.congress.gov/bill/116th-congress/house-bill/6395/text>
- 11 <https://www.openranpolicy.org/wp-content/uploads/2020/06/Open-RAN-Policy-Coalition-Comment-for-National-Strategy-for-Secure-5G-6.25.2020-as-filed.pdf>
- 12 The O-RAN Alliance was created to promote adoption of Open RAN solution. <https://www.o-ran.org/>
- 13 MITRE recognizes that U.S.-based manufacturing (the geographic distinction) is most important, and that until Open RAN is mature, the United States would most likely not have an opportunity for infrastructure manufacturing by a currently U.S.-owned company.
- 14 Wilmer Hale report on “U.S. Decoupling from China and the Onshoring of Critical Supply Chains: Implications for Private Sector Businesses,” 26 August 2020.
- 15 <https://www.politico.com/news/2020/08/13/us-adds-slovenia-to-its-anti-huawei-coalition-of-the-willing-394784>

About the Authors

Christine Gilbert is a Senior Principal with MITRE's Enterprise Strategy & Transformation (ES&T) Innovation Center and serves as ES&T's Business Performance Leader with responsibility for Strategy and Operations. Christine is a certified strategic management professional with twenty years of leadership experience in domestic and international strategy development and execution, corporate development, strategic process optimization and change management. She has demonstrated experience leading cross-cultural teams tackling challenging business and technology issues to produce measurable results.

Jim Houchens is the Director of MITRE Labs Mobility and 5G Platform, as well as MITRE's Chief Engineer for Indo-Pacific Regional Operations. During Jim's 34-year career at MITRE, Jim has held various senior engineer positions including the Chief Engineer for Intelligence Programs, responsible for integration and technical quality oversight of MITRE's efforts in support of the Intelligence Community. Jim is one of MITRE's premier experts on cellular technology and mobile security with a special interest in innovative application of 5G/NextG technologies.

Christopher Moeller is an engineer leading financial intelligence efforts for the Treasury, Economics, and Commerce Division at MITRE. For nearly a decade, Christopher has worked across government stakeholders in the intelligence community, law enforcement, and defense mission space. Christopher holds a B.A. in accountancy from Auburn University and is a certified anti-money laundering specialist and project management principal.

Arman Mozahebi is a lead communications engineer at MITRE with over 25 years of experience in IT Infrastructure Engineering with a specific focus in the design, deployment and optimization of Radio Access Networks (RAN) and 5G Technology. He provides wireless communications and 5G subject matter expertise to both civilian and defense sponsors. Arman holds a bachelor's degree in Business Management with an emphasis in Electronics Engineering.

Maggie Vencill is a Project Leader in MITRE's program with the Office of the Secretary of Defense for Research and Engineering. Maggie is a certified Lean Six Sigma Black Belt with twenty years of experience in the commercial and government sectors. Maggie's areas of expertise are project management, acquisition strategy, and technology protection.

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About MITRE

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