Magic Quadrant for 5G Network Infrastructure for Communications Service Providers

This Magic Quadrant helps communications service providers identify and evaluate network equipment providers for their 5G network infrastructure. This end-to-end 5G network infrastructure includes RAN, core network, transport and network infrastructure services.

Market Definition/Description

Gartner defines the 5G network infrastructure as capabilities that support communication service providers (CSPs) to provide connectivity services such as mobile broadband, fixed wireless access and voice communication over a 5G network. Gartner considers 5G to be foundational technology, implemented to evolve a CSP's core business process, including consumer business and enterprise business sectors.

The core capabilities of the 5G infrastructure include:

- Radio access network equipment, including radio units (RU), base band units (BBU) for 5G new radio and 4G LTE:

  o Passive antennas, RU, AAU, vBBU, BBU, DU, CU, vDU, vCU, small cell

- Core network equipment, including 5G next-generation core and evolved packet core (EPC):

  o UPF, AMF, SMF, PCF, AUSF, UDM, NSSF, NRF, NEF, NWDAF for 5G

  o MME, S-GW, P-GW, IMS, HSS, PCRF, EPC/vEPC for 4G LTE

There are additional 5G technologies and capabilities that are necessary for supporting CSPs' effective 5G deployment. These include, but are not limited to:

- Transport network equipment: Fronthaul, midhaul, backhaul, wireless backhaul

- Network infrastructure services: Design, build, run, support

This 5G network infrastructure discussed in this research covers both 5G non-stand-alone (NSA) and stand-alone (SA) architecture. Also, 5G dynamic spectrum sharing (DSS) that reuses current 4G LTE spectrum bandwidth and 4G infrastructure is covered.

This research addresses wireless CSPs that deploy 5G networks and provide communication services to subscribers over the public network infrastructure. Private mobile networks (e.g., private LTE, private 5G and local 5G) that are deployed by enterprises are not included.

This research is Gartner's first 5G network-infrastructure-related Magic Quadrant and replaces the previous Magic Quadrant for LTE Network Infrastructure and Market Guide for 5G New Radio Infrastructure.

The worldwide market for end-to-end 5G network infrastructure includes 10 vendors that provide both radio access and core network elements for 5G (see Figure 1).

Magic Quadrant

Figure 1: Magic Quadrant for 5G Network Infrastructure for Communications Service Providers
Source: Gartner (February 2021)

Vendor Strengths and Cautions

Cisco

Cisco is a Niche Player in this Magic Quadrant. It is a U.S. multinational technology conglomerate and is focusing on telco cloud, mobile core, SDN transport and automation with its 5G business. Although Cisco was a major player in the EPC segment of LTE (except for the classical radio access network [RAN] equipment), the company is active in its Open vRAN ecosystem.

Strengths

- Cisco's Virtualized Packet Core receives major CSPs' interest, and it supported T-Mobile US's industry-first 5G SA network by supplying UPF, SMF and PCF. The company has been a forerunner in Internet Protocol (IP) technology, which is an advantage because EPC/5G core is an all-IP network technology.

- Despite recent pressure on revenue, Cisco has one of the highest ratings among the vendors featured in this Magic Quadrant on financial viability due to its strong balance sheet and ability to generate meaningful cash flow. CSPs seeking a partner with strong financial viability and established credibility should consider Cisco.

- Cisco has established a strong ecosystem in Open vRAN, which includes all the major players in this domain. This includes Altiostar, Intel, Red Hat, JMA Wireless, Radisys, Blue Danube Systems, Tech Mahindra, Mavenir, World Wide Technology, ASOCS, VIAVI, RF Pixels, Parallel Wireless and NEC. Various CSPs are also interested in Cisco's Open vRAN solution. Etisalat has announced its intention to test Cisco products on its Open vRAN. Telenor Group has started an Open vRAN trial with Cisco in Norway. Rakuten Mobile selected Cisco as a key partner for its 4G vRAN.

Cautions

- Cisco's RAN portfolio does not include macrocell/microcell base stations and cannot fulfill CSPs' requirements there.

- Although Cisco did win NFVI, VIM and some vEPC functions in the deal with Rakuten Mobile's fully virtualized 4G LTE, Rakuten Mobile selected other players on its 5G cloud-native network (RAN and Core). CSPs should carefully evaluate the company's open 5G vRAN capabilities.

- The perception, as observed by Gartner among some CSPs, is that Cisco is still principally an enterprise player.

Ericsson

Ericsson is a Leader in this Magic Quadrant. It is a Swedish multinational networking and telecommunications company that offers services, software and infrastructure in information and communications technology for CSPs. Ericsson has long had a strong focus on 3rd Generation Partnership Project (3GPP)-based mobile networks, and it was one of the leaders in terms of numbers of LTE deals. The company's end-to-end 5G offerings, including Ericsson Radio System, 5G Core, Orchestration and 5G Transport, together with its professional services, help it maintain a strong position to win 5G business.

Strengths

- Its leadership in the 5G technology evolution, with improvements such as dynamic spectrum sharing (DSS) and Uplink Booster, gave the company first-mover advantage and has been enhancing its mind share.

- Ericsson announced its 100th commercial 5G agreement with unique CSPs in August 2020. Based on our counting, Ericsson also possesses the largest number of 5G deals, which can be derived from its strong product portfolio and execution capabilities.

- Its radio products within Ericsson Radio System delivered since 2015 can support 5G NR capability through remote software installation. This prescience and flexibility enabled its clients to launch 5G networks earlier than other competitors.

Cautions

- Although Ericsson has enhanced its radio portfolio through its Kathrein acquisition, it has a narrower radio unit portfolio and slower feature support than some competitors. For example, this includes the number of massive MIMO products, IBW 400 MHz massive MIMO and 5G microcell.

- Several CSPs have noted that Ericsson can sometimes lack flexibility and a customer-oriented culture. For example, some CSPs have to align with Ericsson's features, roadmap and delivery priorities, rather than the other way around.

- With respect to Open RAN and vRAN, Ericsson follows these promoters and is in a defensive position in which it is forced to accept multivendor integration.

FiberHome Telecommunication Technologies

FiberHome Telecommunication Technologies (FiberHome) is a Niche Player in this Magic Quadrant. FiberHome is a Chinese information and communications technology vendor. As a result of FiberHome's merger with Datang Telecom Group, the company combines the strength of both and focuses on communication technology in broadband construction, 3G/4G/5G and informatio security. In the mobile infrastructure business, the company is able to offer end-to-end solutions for TD-LTE networks and 5G, including core, radio access and optical transport. It also has a strong presence and solution in the China C-V2X domain.

Strengths

- FiberHome's leading position in the Chinese optical communications market and close relationships with domestic CSPs can be leveraged to stay relevant in the 5G market. In the latest China mobile 5G RAN equipment central bid, the company won 2.6% market share, which means more than 6,000 base stations.

- FiberHome is a leading supplier of China Mobile Slicing Packet Network (SPN) equipment, an innovative technology for 5G network transport network slicing.

- FiberHome has a good portfolio and solution in industrial 4G/5G solutions, especially in intelligent manufacturing, smart energy and C-V2X.

Cautions

- The merger and portfolio consolidation between Datang Telecom Group and FiberHome took longer than expected, which caused uncertainty and had a negative impact on the new product development and launch.

- FiberHome, compared with leading 5G vendors, does not have a comprehensive 5G infrastructure product portfolio or SI capabilities. In addition, it lacks a strategy for emerging technologies in open RAN or cloud transformation. Both of these limited its capabilities in embracing new technology ecosystems.

- FiberHome currently still doesn't have a strong global expansion strategy and lacks awareness outside China. This further enlarges the gap between its financial and technology capabilities and those of the leading vendors.

Fujitsu

Fujitsu is a Niche Player in this Magic Quadrant. It is a Japanese information and communications technology vendor focused on seven key technology areas, including 5G. Because its mobile network infrastructure business was very focused on the Japanese market, its international business was based on providing original equipment manufacturer (OEM) radio through other vendor partners. Fujitsu has been promoting open and virtualized base stations, and is initially focused on selling 5G RU to the global market.

Strengths

- Fujitsu is proactively participating in the O-RAN Alliance and is fairly contributing in the development of the open interface to expedite the collaborative process to the accelerated readiness of multivendor O-RAN-compliant network infrastructure. Its open RU products and network integration expertise did contribute to its ability to acquire the 5G agreement with DISH Network.

- A significant share of NTT DOCOMO's early investment in 5G in Japan went to Fujitsu. Fujitsu also launched Japan's first commercial private 5G network. Thanks to this leadership and presence, Fujitsu can improve its product quality quickly.

- Vodafone announced OpenRAN Hardware Radio RFI results in October 2020, and Fujitsu was honored for multiband RRH and portfolio breadth there. The company is riding the momentum of Open RAN and gaining recognition.

Cautions

- Fujitsu is now undergoing a major reorganization to become a digital transformation (DX) company, and its network infrastructure business is not a major revenue source for the company. CSPs should carefully evaluate the company's business support and continuity.

- A 5G partnership between Fujitsu and Ericsson was announced in 2018, but this partnership focused first on the Japanese market. Fujitsu and Ericsson globally announced an additional release related to wireless connectivity for Industry 4.0 in 2019, but there is no clear go-to-market strategy or public reporting of business progress.

- Fujitsu's 5G infrastructure product portfolio is not as comprehensive as that of the Magic Quadrant Leaders, especially in regions outside of Japan.

Huawei

Huawei is a Leader in this Magic Quadrant. Huawei is a Chinese information and communications technology (ICT) vendor, and its business spans carrier business, consumer business and enterprise business. The company's global 4G LTE network business success came from its end-to-end robust cellular network portfolio including macrocells, small cells, single RAN and converged core, as well as transport network. The company plans to contribute to CSPs by providing an enhanced 5G product portfolio.

Strengths

- Since 2009, Huawei has been investing in 5G R&D to build a leading technology. Huawei is a leading contributor in terms of the number of 5G basic patents defined by ETSI and the number of 5G submitted contributions defined by 3GPP.

- Huawei offers more scale and breadth in its 5G-related portfolio than its competitors. Huawei has various series of radio products including 400 MHz wideband AAU and blade AAU, and strong features such as scenario-based beamforming, Super Uplink, energy saving solution (Green 5G), and network slicing, as well as AI-based network operation and automation. Another differentiator is its WTTx product (Huawei's brand of FWA based on 4G and 5G technology), which provides not only network equipment but also devices, including customer premises equipment and the service provision and management system (WTTx Suite).

- Huawei's 5G network business is well-positioned in China, Asia/Pacific and some European countries, as well as in the Middle East due to its strong footprint in 4G. Huawei established a large and global service organization to support its installed base of customers. Its global service organization provides support in more than 170 countries.

Cautions

- With increasing tension between the U.S. and China, and increasing political resistance and security concerns about Chinese vendors' products in certain nations and regions, Huawei's operations and efforts entering — and even announcing — new 5G contracts may be impacted.

- Although Huawei claims that it has stored enough chips for its enterprise-oriented businesses, including telecom base stations, the geopolitical rivalry over 5G provides an uncertainty about its midterm to long-term supply chain. CSPs should monitor Huawei's ability to apply state-of-the-art manufacturing processes to its 5G products.

- Huawei believes that currently dedicated hardware equipment, including 5G base stations, has obvious advantages in performance and power consumption in comparison with Open RAN and vRAN. However, this strategy limits Huawei as a vendor in addressing strategic Open RAN/vRAN initiatives and projects pursued by various CSPs.

Mavenir

Mavenir is a Niche Player in this Magic Quadrant. It is a U.S. network software provider in the telecommunications industry. The company launched a fully virtualized 4G/5G open RAN solution in October 2019 and plans to help CSPs break the vendor lock-in situation and discontinue old legacy business models as fast as possible. The company used to be a voice and messaging vendor. But in 2017, the company merged with Xura, which had acquired Ranzure Networks, to become an end-to-end cloud-native network software provider. The company announced on 6 October 2020 that it had publicly filed a registration statement on Form S-1 with the U.S. Securities and Exchange Commission relating to a proposed initial public offering of its Class A ordinary shares, but withdrew it on 30 October 2020.

Strengths

- Various CSPs, including BT, DISH Network, Deutsche Telekom, NTT DATA, O2 UK, Turkcell, Vodafone Idea and Vodafone UK, have been tackling Open RAN through a Mavenir partnership. Mavenir is one of the major new entrants in Open RAN, and this first-mover advantage can improve its product, services and mind share.

- Mavenir has already been named as a vRAN partner by major cloud players, including Amazon Web Services, Microsoft and VMware. Its commitment to cloud native allows Mavenir to provide its solution in an agile and efficient manner when RAN becomes fully virtualized and cloudified

- Mavenir's acquisition of ip.access can expand its open RAN portfolio, especially by adding 2G and 3G capabilities, which are missing in its current product portfolio.

Cautions

- Pure software vRAN using only a COTS server would not be commercially viable for 5G mostly due to its massive processing needs. vRAN requires external hardware accelerators, but it is not mature as a purpose-built 5G base station to assure optimal network performance and efficiency. Mavenir needs to demonstrate its solution value to persuade incumbent MNOs.

- Mavenir is focusing on building general-purpose RAN reference designs for 4G and 5G Open RAN by contributing to Telecom Infra Project's (TIP's) Evenstar program. This could be a sign for Mavenir to be an end-to-end player directly competing with other incumbent vendors. CSPs should watch to see whether Mavenir can continue to join together with others to promote Open RAN.

- While Open RAN standardizations, including the O-RAN Alliance and TIP, are progressing, multivendor interoperability over interfaces such as Fronthaul, X2, Xn and Xx are not commonly available for CSPs. Mavenir needs to achieve this multivendor integration by working with various stakeholders.

NEC

NEC is a Visionary in this Magic Quadrant. It is a Japanese information and communications technology vendor, and its vision is to be a solution and business co-creator for digital service providers. NEC, along with its fully owned subsidiary Netcracker, is providing highly reliable 5G networks to CSPs and industry players through the integration of IT and network technologies. The company is targeting to be a system integration player in addition to product/solution supplier in Open RAN by expanding its NEC Vertical Business Platform.

Strengths

- NEC has established a position in large-scale 5G deployments in Japan by supporting its CSP clients: NTT DOCOMO and Rakuten Mobile. Its clients evaluated NEC's technology capabilities, openness and system integration expertise.

- Various foreign markets are interested in NEC's Open RAN solution. Vodafone announced OpenRAN Hardware Radio RFI results in October 2020, and NEC was honored for massive MIMO, most efficient mechanical design and portfolio breadth at TIP's summit. Etisalat and VodafoneZiggo have announced their intention to test NEC products on their Open RAN. In October 2020, Britain's Department for

International Trade said NEC will "support roll out of 5G in the U.K.," and the company plans to create a 5G Open RAN Center of Excellence in the U.K.

- NTT decided to take a 5% stake in NEC in June 2020. The partnership aims to ensure Japan has its own homegrown 5G technology and to collaborate on next-generation 6G and NTT's proposed Innovative Optical and Wireless Network (IOWN) to be delivered globally.

Cautions

- NEC plans to sell its products and solutions directly or through partners such as Rakuten Mobile in foreign markets, but its execution ability is not assured.

- The 5G partnership between Samsung and NEC was enhanced to establish a global sales team in June 2019 and realized multivendor connectivity with new CU/DU in the NTT DOCOMO network in September 2020. However, CSPs need to observe the progress carefully.

- NEC's 5G infrastructure product portfolio is not as comprehensive as that of the Magic Quadrant Leaders, especially in regions outside of Japan.

Nokia

Nokia is a Leader in this Magic Quadrant. It is a Finnish multinational telecommunications and information technology company. While Nokia's telecom infrastructure business has grown through multiple acquisitions and mergers, such as Alcatel-Lucent, a new CEO took the helm of the company in August 2020 and announced a new operating model and strategy refresh. Its business focuses on mobile, fixed IP and optical networks, cloud, and network services, supported by patents and standards from Nokia Bell Labs. Nokia is one of the market leaders in terms of numbers of 4G LTE deals and is trying to follow the same path with 5G contracts.

Strengths

- Nokia announced its 100th commercial 5G agreement with unique CSPs in October 2020. Based on our counting, Nokia is one of the leaders in terms of the number of 5G deals. This comes from its 5G solution that includes radio and core networks, transport, network management, security products, and professional services.

- Nokia's early commitment to vRAN, cloud RAN and Open RAN succeeds in differentiating it from other incumbent RAN vendors. This has also given the company some level of thought leadership.

- Nokia's Enterprise business group, which provides telecom-grade networking capabilities, including private LTE and 5G networks to enterprises, is seen as an industry leader regarding the number of private LTE deals globally.

Cautions

- Nokia announced its delay of the new ReefShark chipset development used for 5G radio, baseband and massive MIMO antennas in October 2019. The company's products tend to be inferior to other major vendors because its initial selection of

field-programmable gate array (FPGA) was not cost-effective and didn't provide good performance. While Nokia has selected multiple vendors such as Broadcom, Intel and Marvell to resolve the issue, CSPs should be sensitive about its chipset development, delivery and product integration.

- Several CSPs have noted that Nokia's 5G product and service are not as good as other competitors, including its performance and responsiveness. Nokia's product quality, software stability, bug fix services and schedule adherence need to be further improved.

- Nokia has reduced its market share with a few CSPs in advanced markets such as China and the U.S. at the transition from 4G to 5G. This could result in missed opportunities, including product enhancements and business profitability from early 5G investments in leading markets.

Samsung

Samsung is a Visionary in this Magic Quadrant. It is a South Korean multinational conglomerate that includes Samsung Electronics, Samsung Heavy Industries, Samsung Engineering and Samsung C&T. Samsung Electronics is responsible for the network business and is a relatively late participant in the business of 3GPP-based cellular technology. While its local CSP clients adopt both RAN and core solutions, Samsung's global 5G network business mainly comes from RAN. It is an early innovator of new cellular technologies, such as vEPC, small cell and vRAN, and Verizon announced that the first successful end-to-end virtualized 5G is supported by Samsung and other partners.

Strengths

- Samsung contributed to the world's earliest massive commercial adoption of 5G in South Korea, leading in share at the top three local CSPs. Given its leading experience in South Korea, it has driven advanced features and capabilities such as millimeter wave radio, in-house chipsets and virtualized solutions that translate well to other markets.

- While its previous 4G LTE business was limited to South Korea, the U.S., Japan and India, the company has already acquired new 5G contracts in the U.S., Canada and New Zealand. With a flexible approach to its network solutions, supporting various architectural approaches (single RAN vendor, multivendor or virtualized RAN), Samsung has the potential to become another vendor partner candidate for CSPs. This is especially the case for those that have some difficulties with finding multiple vendor partners for their 5G network.

- Samsung has increased its capacity to support its growing business and has expanded its end-to-end network services offering and support with strategic acquisitions, including Zhilabs and TeleWorld Solutions.

Cautions

- Samsung's lack of presence in the 2G/3G/4G network infrastructure market globally hampers its ability to expand its share of the 5G network infrastructure market, as CSPs tend to favor incumbent vendors for upgrades.

- The 5G partnership between Samsung and NEC was enhanced to establish a global sales team in June 2019 and realized multivendor connectivity with a new CU/DU in the NTT DOCOMO network in September 2020. However, CSPs need to observe the progress carefully.

- Samsung's commercial 5G deals are still limited in the world compared with Magic Quadrant Leaders, and Samsung's mobile core network business, especially, has not yet proliferated as its RAN business has.

ZTE

ZTE is a Visionary in this Magic Quadrant. ZTE is a major Chinese information and telecommunications technology vendor that provides three core businesses: telecommunications equipment, smartphones and other mobile terminals, as well as system integration services. The company has a complete telecommunications products line — covering wireless and wired infrastructure, core networks, software systems and services, and Internet of Things — that enables it to meet diversified requirements.

Strengths

- ZTE has a strong 5G portfolio — covering radio, core and transport — that is able to meet diversified requirements. It is able to deliver many innovative 5G technologies and features such as SuperDSS, massive MIMO, concise multi-RAT and multiband site, AI-driven smart operation, and energy saving, as well as network slicing and converged 5G core.

- ZTE contributed to the world's biggest 5G adoption in China, and is a main supplier of the early 5G stand-alone rollout in China. Participation in such large-scale and complex 5G deployment allows ZTE to quickly mature its products, and the experience can improve its competitiveness in other markets.

- The company has a strong customer base in China, and it also taps into global markets including South East Asia, Europe and Africa by 5G. ZTE is also a reliable partner in different markets for its swift response to customers' requirements.

Cautions

- The increasing political resistance and security concerns about Chinese vendors' products in certain nations and regions may limit ZTE's operations and efforts to expand into new markets as well as gain new 5G contracts.

- U.S. sanctions imposed on ZTE in 2018 had a negative impact on customer confidence and mind share, especially in the markets outside China.

- ZTE has less LTE market share in comparison with the three Magic Quadrant Leaders. This can also impact its 5G global marketing strategy, as leading CSPs currently deploying 5G mainly use the NSA mode, which favors incumbent LTE vendors.

Inclusion and Exclusion Criteria

Network equipment providers (NEPs) in this Magic Quadrant need to possess radio access network equipment and core network equipment for 5G, and these products should be generally available. General availability is defined as something a vendor's clients have in a production environment, rather than something they are testing or evaluating. Vendors are also required to possess at least one 5G commercial contract with CSPs.

Vendors could be excluded if they do not demonstrate market commitment by responding to our formal RFI process.

Evaluation Criteria

Ability to Execute

Product or Service

This criterion includes products and services offered by the vendor that compete in the defined market (radio and core network elements for 5G carrier infrastructure). This includes current product and service capabilities, quality, feature sets and skills, whether offered natively or through OEM agreements or partnerships, as defined in the Market Definition/Description section. Backhaul and fronthaul networks are also included. Network infrastructure service offerings, including system integration skills specifically relating to 5G, are also considered.

Overall Viability

This criterion includes an assessment of the overall organization's financial health, which underpins the financial and practical success of the relevant 5G business unit. It also considers the likelihood of that business unit continuing to invest in the product, offer the product and advance the state of the art within the organization's portfolio.

Market Responsiveness and Track Record

This is the vendor's ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customers' needs evolve and market dynamics change. This criterion also considers the vendor's history of responsiveness, its market share, and its market traction demonstrated through 5G contract wins. In addition, it covers the vendor's ability to adapt and scale activities to work with its own partners, as well as crucial third parties (such as regulators, municipalities and civil works contractors). In other words, it assesses the vendor's ability to "cast a wide net" while still being able to execute and scale quickly when opportunities turn into actual 5G contracts.

Disclaimer statement: In this subcriteria, Gartner has applied contract data information and considered only publicly verifiable 5G contracts with named customers. Please note that vendors evaluated in the Magic Quadrant may have a larger number of won 5G contracts that they can't reveal publicly due to nondisclosure agreement limitations.

Marketing Execution

This criterion includes the clarity, quality, creativity and efficacy of programs designed to deliver vendors' messages to influence the market, promote vendors' brand and business, increase product awareness, and establish a positive identification with vendors' products, brand and organization in CSPs' minds. This mind share can be driven by a combination of publicity, promotion, thought leadership, word of mouth and sales activities. The quality of the response to our Magic Quadrant RFI is also considered.

Customer Experience

This criterion includes relationships, products, services and programs that enable CSPs to succeed with the products evaluated. Specifically, this includes the ways in which CSPs receive technical support or account support. It can also include ancillary tools, customer support programs (and the quality thereof), the availability of user groups and SLAs.

We determined each vendor's position by evaluating it against the criteria in Table 1.

<p style="text-align:center">Table 1: Ability to Execute Evaluation Criteria</p>

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Evaluation Criteria
Product or Service
Overall Viability
Sales Execution/Pricing
Market Responsiveness/Record
Marketing Execution
Customer Experience
Operations

Source: Gartner (February 2021)

Completeness of Vision

Market Understanding

This criterion includes the ability to understand CSPs' needs and translate them into products and services. These vendors show a clear vision of their market — listen, understand customer demands, and can shape or enhance the market changes with their added vision. The ability to see 5G in the wider context of CSPs' overall network modernization strategies is of particular importance, provided this insight is reflected directly in the product roadmap of the vendor.

Marketing Strategy

This includes clear, differentiated messaging consistently communicated internally and externalized through social media, advertising, customer programs and positioning statements. It involves alignment of the vendor's 5G marketing strategy with its current market position and its overall 5G portfolio strategy, including a regional sales strategy focus.

Offering (Product) Strategy

This criterion includes an approach to product development and delivery that emphasizes market differentiation, functionality, methodology, and features as they map to current and future requirements. This includes differentiated approaches to the different 5G segments, including Tier 1 CSPs, Tier 2 CSPs and Tier 3 CSPs.

Vertical/Industry Strategy

This criterion includes the vendor's ability to cross-pollinate between industries. It includes bringing best practices from other industries to CSPs and helping CSPs take communications capabilities to other industries. The strategy directs resources (sales, product, development), skills and products to meet the specific needs of individual market segments, including verticals.

Innovation

This criterion includes direct, related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or preemptive purposes. This also includes sustained evidence of technological expertise and leadership, demonstration of appropriate budget for R&D planning, active participation and leadership of 5G standardization and related activities, and support for ecosystem partners via interfaces and interoperability.

Geographic Strategy

This criterion includes the vendor's strategy to direct resources, skills and offerings to meet the specific needs of geographies outside the "home" or native geography, either directly or through partners, channels and subsidiaries, as appropriate for that geography and market.

We determined each vendor's position by evaluating it against the criteria in Table 2.

Table 2: Completeness of Vision Evaluation Criteria

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Evaluation Criteria

Market Understanding

Marketing Strategy

Sales Strategy

Offering (Product) Strategy

Business Model

Vertical/Industry Strategy

Innovation

Geographic Strategy

Quadrant Descriptions

Leaders

Leaders typically have a significant number of commercial references for the 5G network equipment market. They also have momentum in this area, as exemplified by new contract wins. They have a broad portfolio and, even where they need partners, they are the preferred prime vendors for CSPs. They appear in nearly all CSP procurements and trials of 5G infrastructure as de facto suppliers, and their presence in the Leaders quadrant tends to be fairly stable. These are high-viability technology providers. They are well-positioned with their current product portfolios and are likely to continue to deliver leading products. Leaders do not necessarily offer the best solution for every customer requirement, and their products may not be "best of breed" in every area. Overall, Leaders provide solutions that offer relatively low risk and can achieve and sustain deployments of high quality.

Challengers

Challengers have strong market execution capabilities and good solutions, but overall, their products lack the breadth and depth of those of Leaders. Their solutions

do not indicate a clear vision for how the market is evolving and they are not as innovative or advanced as those of Leaders.

Visionaries

Visionaries demonstrate a clear understanding of the market and provide key innovative elements that are illustrative of the market's future. They lack the ability to influence a large part of the market, or have not yet fully expanded their sales and support capabilities to achieve global reach, or do not yet have the funding and scale to execute with the capabilities of Leaders.

Niche Players

Niche Players tend to offer products that focus on a particular segment of the market (for example, a given country, such as Japan) or a subset of functionality (such as vRAN). They also tend to be more specialized with regard to technology and products. This can be an advantage, because CSPs aligned with the focus of Niche Players can find these vendors' offerings very suitable. In some cases, Niche Players have made specific decisions about where and where not to compete, so being a Niche Player does not preclude having a well-defined strategy. They could also prove to be attractive partners for some of the larger vendors in this market, thanks to their market specialisms or technological strengths.

Context

Use this Magic Quadrant as a reference, but explore the market further beyond these providers. The Magic Quadrant is not the sole Gartner tool for creating a vendor shortlist. Also consider other Gartner reports (see the Recommended by the Author section) and discussions with Gartner analysts.

Gartner advises CSPs to base their choice of external NEP on the following:

- An evaluation of multiple vendor selection (at least two) for 5G infrastructure to enable service continuity and smooth negotiation

- The NEP's willingness to work together with other stakeholders (sometimes their competitor) to achieve CSPs' overall network modernization strategies

- Business value assessment against the most important goals of their organization

Market Overview

As of August 2020, more than 90 3GPP-compliant 5G networks in 38 countries/territories have been commercially launched, according to GSA. Most of them deployed 5G networks relying on an anchor in the 4G radio access and core network. This is so-called non stand-alone (NSA) architecture, and it is natural for incumbent mobile CSPs to adopt this as an interim solution. Advanced CSPs such as T-Mobile US have launched 5G stand-alone (SA) services by adopting 5G NG core, but this is not enough to achieve end-to-end network modernization. To provide real 5G value, CSP networks need to be more agile, flexible and reliable by technical

innovations, including edge computing, software-defined network/network function virtualization (SDN/NFV), orchestration/automation and network slicing.

The journey of 5G has begun with small steps, and this technology and related business and services will evolve in the next 10 years. Currently, 5G coverage is very limited, and 5G subscription plans and capable devices are expensive, but these challenges of CSPs' consumer business will be solved gradually in the next several years. These challenges are similar to those CSPs encountered with the introduction of 2G/3G/4G in the past. However, the monetization of 5G enterprise business will be a key challenge for the telecom industry in the 2020s. A "radio access only" or "technology oriented" approach will not be enough to make CSPs succeed in 5G. 5G NEPs need to contribute CSPs to identify client demands and provide issue-driven solutions. Although the current vendor lock-in situation could stagnate the 5G monetization, various vendors and solution providers related to vRAN, vEPC, NFVI platform and others are emerging. Their momentum is driven by virtualization, cloudification, open-source and network automation.

This Magic Quadrant examines vendors of end-to-end 5G network infrastructure. This end-to-end indicates that RAN and core network equipment are mandatory, and transport network equipment and network infrastructure services are optional. Gartner also monitors various vendors that do not yet meet the minimum criteria for inclusion because they do not offer end-to-end 5G network infrastructure, instead focusing on only some business segments. For example, Altiostar and Parallel Wireless provide vRAN solutions; KMW, Mitsubishi Electric and PHAZR offer radio antenna products; and Comba Telecom and CommScope provide small cell solutions. In addition, Affirmed Networks (now Microsoft) provides vEPC; Oracle provides 5G core signaling and policy solutions; and Red Hat and VMware provide NFVI solutions.

Based on our [Market Share: Communications Service Provider Operational Technology, Worldwide, 2019](#), the market share of top four vendors (Ericsson, Nokia, Huawei and ZTE) on the mobile carrier network infrastructure is around 90% in 2019. While greenfield CSPs such as DISH Network and Rakuten Mobile are deploying 5G supported by new vendors of Open RAN and vRAN, incumbent CSPs such as Airtel, Etisalat, Telefonica and Vodafone are accelerating the similar initiatives using Telecom Infra Project. Open ecosystems could destroy the existing vendor lock-in situation and require multivendor interoperability between different network nodes. Incumbent NEPs, such as Cisco, Fujitsu, NEC, Nokia and Samsung, have also committed to Open RAN and vRAN. This competition will contribute to the future success of 5G by CSPs.

The race to win business in the 5G infrastructure market has just started, and vendors are achieving different degrees of traction when it comes to securing commercial contracts with CSPs. To gauge how well vendors meet the requirements, Gartner scores them using a series of criteria that we developed to capture their capabilities when it comes to addressing CSPs' wants and needs for end-to-end 5G infrastructure, as described above. These criteria are summed up in our framework as vendors' Ability to Execute and Completeness of Vision.

Evidence

This evaluation is based on the following information sources:

- A detailed survey sent to vendors addressing their global capabilities. The survey covered the evaluation criteria discussed in this document.

- Vendors' representation of their organizations through other briefings, meetings, press releases, annual reports and additional publicly available information.

- Discussions between Gartner analysts and clients throughout the year about the companies featured in this research.

- Other Gartner research covering the vendors from additional angles, as well as input from other Gartner analysts who follow the represented companies.

- Surveys conducted to investigate all available and relevant commercial contracts for 5G involving the vendors concerned.

- Country- and region-specific views, provided by local Gartner analysts, as appropriate.

Evaluation Criteria Definitions

Ability to Execute

Product/Service: Core goods and services offered by the vendor for the defined market. This includes current product/service capabilities, quality, feature sets, skills and so on, whether offered natively or through OEM agreements/partnerships as defined in the market definition and detailed in the subcriteria.

Overall Viability: Viability includes an assessment of the overall organization's financial health, the financial and practical success of the business unit, and the likelihood that the individual business unit will continue investing in the product, will continue offering the product and will advance the state of the art within the organization's portfolio of products.

Sales Execution/Pricing: The vendor's capabilities in all presales activities and the structure that supports them. This includes deal management, pricing and negotiation, presales support, and the overall effectiveness of the sales channel.

Market Responsiveness/Record: Ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the vendor's history of responsiveness.

Marketing Execution: The clarity, quality, creativity and efficacy of programs designed to deliver the organization's message to influence the market, promote the brand and business, increase awareness of the products, and establish a positive identification with the product/brand and organization in the minds of buyers. This "mind share" can be driven by a combination of publicity, promotional initiatives, thought leadership, word of mouth and sales activities.

Customer Experience: Relationships, products and services/programs that enable clients to be successful with the products evaluated. Specifically, this includes the ways customers receive technical support or account support. This can also include ancillary tools, customer support programs (and the quality thereof), availability of user groups, service-level agreements and so on.

Operations: The ability of the organization to meet its goals and commitments. Factors include the quality of the organizational structure, including skills, experiences, programs, systems and other vehicles that enable the organization to operate effectively and efficiently on an ongoing basis.

Completeness of Vision

Market Understanding: Ability of the vendor to understand buyers' wants and needs and to translate those into products and services. Vendors that show the highest degree of vision listen to and understand buyers' wants and needs, and can shape or enhance those with their added vision.

Marketing Strategy: A clear, differentiated set of messages consistently communicated throughout the organization and externalized through the website, advertising, customer programs and positioning statements.

Sales Strategy: The strategy for selling products that uses the appropriate network of direct and indirect sales, marketing, service, and communication affiliates that extend the scope and depth of market reach, skills, expertise, technologies, services and the customer base.

Offering (Product) Strategy: The vendor's approach to product development and delivery that emphasizes differentiation, functionality, methodology and feature sets as they map to current and future requirements.

Business Model: The soundness and logic of the vendor's underlying business proposition.

Vertical/Industry Strategy: The vendor's strategy to direct resources, skills and offerings to meet the specific needs of individual market segments, including vertical markets.

Innovation: Direct, related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or pre-emptive purposes.

Geographic Strategy: The vendor's strategy to direct resources, skills and offerings to meet the specific needs of geographies outside the "home" or native geography, either directly or through partners, channels and subsidiaries as appropriate for that geography and market.