ABI RESEARCH COMPETITIVE RANKING

OPEN RAN PORTFOLIO

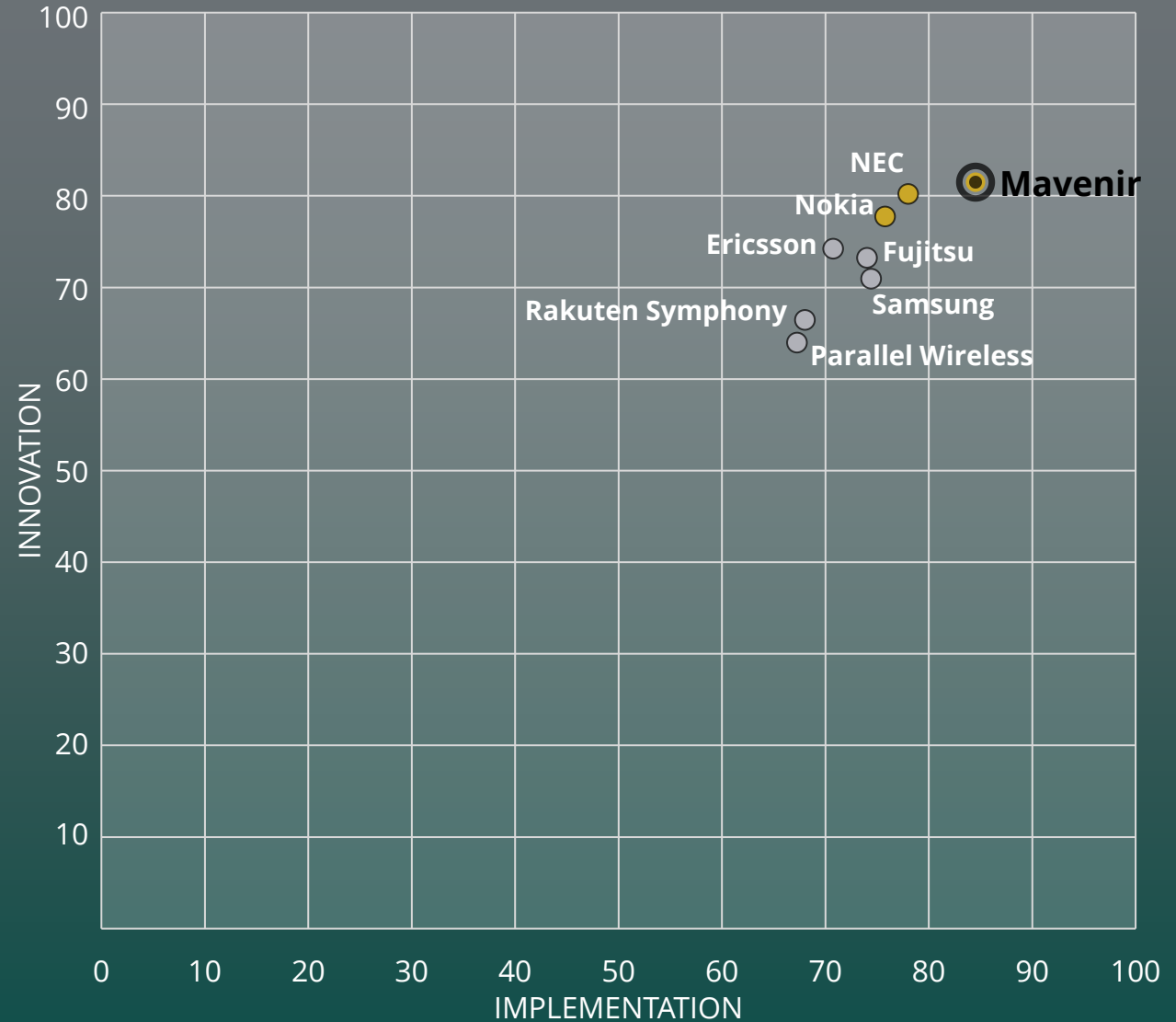**MAVENIR**™

OVERALL LEADER — ABIresearch.

TOP INNOVATOR — ABIresearch.

TOP IMPLEMENTER — ABIresearch.

OVERALL: 83.0 | **INNOVATION: 81.5** | **IMPLEMENTATION: 84.5** | **RANK: 1**

INNOVATION

MAVENIR™

TOP INNOVATOR
ABIresearch

INNOVATION SCORE: 81.5

Mavenir, a U.S.-based company, offers E2E cloud-native software and hardware solutions with a comprehensive portfolio covering core, edge and RAN platforms. In terms of its Open RAN product portfolio, Mavenir's Open vRAN is a fully O-RAN Alliance-compliant, microservices-based solution designed to work with open interfaces supporting both Open RAN split 7-2x and split 2 options. The disaggregated DU and CU work as containerized Network Functions (NFs) that run on COTS hardware. Mavenir's Virtualized CU (vCU) supports Packet Data Convergence Protocol (PDCP) and Radio Resource Control (RRC) layers that can run on COTS hardware deployed on a public or private cloud. Mavenir's Virtualized DU (vDU) supports Radio Link Control (RLC), Medium Access Control (MAC), and High-PHY processing that can be deployed at cell sites or local data centers. Mavenir's Open RAN portfolio also provides RICs that consist of three components, including a Non-RT RIC, Near-RT RIC, and Service Management and Orchestration (SMO) for intelligent RAN control and optimization. Mavenir's Open RAN solution was commercially deployed with DISH Network providing 5G services in a multi-vendor environment supporting more than 40,000 Fujitsu 5G Open RAN radios across 7,000+ cell sites. Considering its wide range of O-RAN Alliance-compliant solution, Mavenir scores an excellent 9.0/10 for its product portfolio.

In terms of R&D, Mavenir has recently won two Open RAN R&D projects as part of the U.K. government's open networks ecosystem competition to optimize Open RAN network performance in High Demand Density (HDD) environments. Currently, approximately 60% of its total workforce is working in R&D capacity. For the R&D criteria, Mavenir scored 7.5 out of 10.

In terms of support for mMIMO, Mavenir scores 8.5 out of 10. Mavenir OpenBeam radio portfolio consists of 64T64R and 32T32R Active Antenna Units (AAUs) that provides 3GPP- and O-RAN Alliance-compliant radio products spanning micro, macro, Millimeter Wave (mmWave) and mMIMO. Mavenir's first-generation AAUs are being deployed and the second generation is currently under development and will be available in early 2024.

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INNOVATION

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In terms of contributions to the O-RAN Alliance WGs, Mavenir scores 7.5, relatively low compared to Nokia, as its contribution in to the O-RAN Alliance is not available publicly. However, Mavenir is an active member and participating in major WGs, including open FH interface, Open Architecture Management (OAM)/SMO. To ensure the multi-vendor interoperability of Open RAN solutions, Mavenir has been collaborating with industry's leading cloud providers, service providers, and testing centers to test O-RAN Alliance-compliant solutions and participating actively in all major PlugFests around the world.

In terms of recent momentum, Mavenir scored 8.5 out of 10. Mavenir is actively driving innovation in all aspects of Open RAN. Mavenir, along with HPE, Casa Systems, and Dell Technologies, managed to integrate Open RAN nodes with 5G Core (5GC) in Standalone (SA) mode to make a successful data connection. Moreover, Mavenir was recognized as the best cloud-native solution at the Open RAN World event in Berlin.

IMPLEMENTATION

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IMPLEMENTATION
SCORE: 84.5

In terms of PoCs/trials and testing, Mavenir holds a strong position by scoring 9.0 out of 10. Mavenir has done a significant number of field trials in the last couple of years. Mavenir has announced several partnerships with Tier One and Tier Two CSPs, cloud providers, and chipset vendors to validate its Open RAN portfolio. For example, Mavenir, along with Orange Spain, HPE, Casa Systems, and Dell Technologies, tested a 5G SA data connection with Open RAN. Recently, Mavenir was awarded Platinum Level Open API conformance status from the TM Forum for its Mavenir Digital Enablement (MDE) Business Support System (BSS) platform. Moreover, Mavenir collaborated with SoftBank and NVIDIA to verify Graphic Processing Unit (GPU)-based vRAN integration with Multi-Access Edge Computing (MEC) on actual machines. Mavenir has been actively participating in O-RAN Alliance PlugFests around the world. For example, Mavenir was able to validate its mMIMO AAUs' integration with Keysight Technologies' O-RU at the i14yLab PlugFest in Berlin, hosted by EANTC, Vodafone, and Deutsche Telekom.

Mavenir scores 8.0 out of 10 for its strong partner ecosystem and memberships. Mavenir is partnering with all major cloud providers, mobile & chipset vendors, and service providers, including Google Cloud, Amazon Web Services (AWS), VMware, Red Hat, HPE, Dell, Fujitsu, Amdocs, Dialogic, NVIDIA, AMD, Qualcomm, HCL, SOLiD, Radisys, Telefónica, Aspire Technology, Airtel, Vodafone, Türk Telekom, Turkcell, SoftBank, Vilicom (rebranded Boldyn Networks), Quickline, Zain, stc, NEC, Deutsche Telekom, DISH Wireless, NTT Data, World Wide Technology (WWT), Triangle Communications, Paradise Mobile, and i2i Systems. In terms of memberships, Mavenir is an active member of several global organizations, including 3GPP, the O-RAN Alliance, ATIS, GSMA, ETSI, 5G America, the NGMN Alliance, Open Network Automation Platform (ONAP), Open RAN Policy Coalition, the Telecom Infra Project (TIP), The Linux Foundation, the TM Forum, etc.

Mavenir is transforming the connectivity by accelerating the software network transformation for CPSs, which serve more than 50% of the total world's subscribers. In terms of geographical focus, Mavenir is serving 300+ CSPs in more than 120 countries. This includes the United States, the United Kingdom, India, Turkey, Japan, South Africa, France, Malaysia, Caribbean, Bermuda, etc. Considering its wider coverage in several countries, Mavenir scored 8.0 out of 10.

IMPLEMENTATION

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IMPLEMENTATION SCORE: 84.5

In terms of energy efficiency, Mavenir secured a solid 8.0 points. Mavenir is fully committed to reducing its carbon footprint and the company has been implementing new and innovative technologies, including sleep modes (symbol shutdown, carrier shutdown, and Radio Frequency (RF) channel reconfiguration) to reduce power consumption in the RAN, mainly in the radio domain. Mavenir is also partnering with chipset vendors to reduce power consumption at the device level (e.g., the Power Amplifier (PA)).

In terms of brownfield deployment, the company outperforms all other vendors by scoring 9.0 out of 10. Mavenir has more than 57 RAN projects with 39 different customers that include 4G, 5G Non-Standalone (NSA), 5G SA (Time Division Duplex (TDD), Frequency Division Duplex (FDD)), small cells, and private networks. All of Mavenir's 5G NSA and most of its 4G deployments are in brownfield environments, whereas Mavenir's 5G SA and private network deployments are mainly greenfield. For example, Mavenir's brownfield deployments include Airtel, Deutsche Telekom, Virgin Mobile/O2, Triangle Communications, etc.

CRITERIA AND METHODOLOGY

VENDOR MATRIX

Methodology: After individual scores are established for innovation and implementation, an overall company score is established using the Root Mean Square (RMS) method:

$$Score = \sqrt{\frac{innovation^2 + implementation^2}{2}}$$

The resulting overall scores are then ranked and used for percentile comparisons.

The RMS method, in comparison with a straight summation or average of individual innovation and implementation values, rewards companies for standout performances.

For example, using this method, a company with an innovation score of nine and an implementation score of one would score considerably higher than a company with a score of five in both areas, despite the mean score being the same. ABI Research believes that this is appropriate as the goal of these matrices is to highlight those companies that stand out from the others.

RANKING CRITERIA

Leader: A company that receives a score of **75 or above** for their overall ranking

Mainstream: A company that receives scores **between 60 and 75** for their overall ranking

Follower: A company that receives a score of **60 or below** for their overall ranking

Innovation Leader: A company that receives a score of **75 or above** for their innovation ranking.

Implementation Leader: A company that receives a score of **75 or above** for their implementation ranking.

INNOVATION CRITERIA

R&D Activities: This criterion counts for the number of Research & Development (R&D) projects, and investment related to Open RAN development. The higher the number of R&D contributions, the higher the score.

O-RAN Alliance Contributions: This defines the involvement that a vendor has in different Work Groups (WGs) in the O-RAN Alliance. The vendor with the greatest number of contributions to O-RAN Alliance WGs scores the highest.

Support for mMIMO: Massive Multiple Input, Multiple Output (mMIMO) is the biggest innovation in 5G and it keeps improving. This criterion defines if the vendor has the capability of implementing innovative solutions in software and hardware to enhance mMIMO performance in terms of spectral efficiency, throughput, and energy efficiency.

Recent Momentum: This metric represents vendors' most recent developments and announcements related to Open RAN developments and deployments.

Product Portfolio: Product portfolio offers consumers a wide range of solutions to deploy Open RAN components, including Open Centralized Unit (O-CU), Open Distributed Unit (O-DU), Open Radio Unit (O-RU), and RIC, and meets specific use case requirements. The vendor with the widest range of solutions with multi-vendor interoperability scores the highest.

MARKET DYNAMICS

5G RAN is going through a paradigm shift toward virtualized, software-defined, and cloud-native RAN components connected via open interfaces. Commercial interest in Open RAN is picking up with a number of operators partially starting to adopt Open RAN for their network deployments. The current market trends in Open RAN deployments are summarized as follows:

- **Open RAN Chipset Developments:** After the market disruptions due to COVID-19, geopolitics, and the energy crisis, Open RAN is helping the mobile industry recover from these challenges. This includes the migration from custom-built Baseband Units (BBUs) to Commercial-off-the-Shelf (COTS) hardware that is gaining momentum with several chipset vendors, including Intel, NVIDIA, Marvell, and Qualcomm, which already started to develop super and integrated chipsets and computing platforms to provide full-stack acceleration in mMIMO implementations. Moreover, the need for hardware acceleration is being widely investigated within the O-RAN Alliance and chipset vendors have started to develop diverse hardware acceleration options for Open RAN.

- **Energy-Efficiency in Open RAN:** As Open RAN equipment is being developed and available commercially, its energy footprint is starting to be discussed, mainly due to sustainability regulations, the energy crisis, and increased operational costs for mobile operators. Reducing the power consumption in mobile networks has become a priority for mobile vendors, operators, consumers, and investors. The industry has already started to find different ways to reduce its carbon footprint. To highlight the importance of energy consumption, ABI Research has conducted a couple of power consumption studies to compare the energy efficiency of Traditional RAN and Open RAN [ref] .

- **RAN Intelligent Controller (RIC):** RIC, which include *Near-Real-Time (RT) RIC* and *Non-RT RIC* is considered the most important feature of Open RAN. It has the capability to intelligently control RAN elements, including O-CU, O-DU, and O-RU, via fine-grained data collection and intelligent decisions over the Southbound (SB) E2 interface. One of the key features of Near-RT-RIC and Non-RT-RIC are rApps and xApps, which are plug-and-play units designed to run on the Near RT-RIC and Non-RT-RIC to define custom logic for the RAN. The RIC processes intensive data by leveraging Artificial Intelligence (AI) and Machine Learning (ML) algorithms, and provides policy-based guidance to optimize radio resource management in the RAN. Major mobile vendors have developed their RIC platforms and concluded field trials. Considering the ongoing interest and competition among vendors, ABI Research forecasts that RICs will be commercially available by 2H 2024 or early 2025 at the latest.

MARKET DYNAMICS

- **R&D Investment at the Government Level:** Governments are taking initiatives and investing in R&D activities related to Open RAN development. For example, the U.K. government announced 19 projects in its Open Networks Ecosystem (ONE) competition and received an £88 million R&D investment related to Open RAN technologies. The government in Brazil allocated US$36 million for research centers to develop 5G, 6G, and Open RAN technology. The U.S. government announced an investment of US$1.5 billion in Open RAN adaptation .

- **Optimal FS for Uplink mMIMO:** Due to the complexity of Physical (PHY) layer processing in mMIMO and performance limitations of a 7-2x split, the O-RAN Alliance initiated a new Work Item (WI) called Uplink Performance Improvement (ULPI) to design a new architecture to complement the established 7-2x split to improve the mMIMO uplink performance and achieve stable interoperability with reduced FH transport cost. The development started during 1Q 2023 and a full specification related to this development is expected by the end of 2023.

Quick Facts Related to the O-RAN Alliance: As of December 2022, the O-RAN Alliance had a total of 32 members and 290+ contributors. Out of 290 companies, only 15 contributors have co-chair positions. There are a total of 11 WGs, each covering a part of the O-RAN architecture and 3 Focus Groups (FGs) that overarch the technical WGs. Recently, the O-RAN Alliance has started to extend its collaboration with other organizations and signed Memorandum of Understanding (MoU) with the OpenAirInterface (OAI) Alliance to collaborate on Open RAN issues and open-source software development. The O-RAN Alliance also signed an MoU with the Alliance for Telecommunications Industry Solutions (ATIS) to accelerate the adaptation of Open RAN specifications. Include product names and linked codes?

IMPLEMENTATION CRITERIA

Geographical Coverage: This criterion counts for geographical coverage that a vendor covers to prove its existence in the market. Is it geographically diverse or concentrated in one specific region? The vendor with a global footprint scores higher than the vendors with regional coverage.

Partnerships & Memberships: The number of partnerships and memberships a vendor has in order to deploy multi-vendor interoperable, End-to-End (E2E) solutions. To score high in this category, a vendor needs a strong vendor and operator partnership for comprehensive service provisioning.

PoCs, Trials, and Testing: This defines the number of lab demonstrations and testing to prove that the idea can be turned into commercial deployment. The Proof of Concept (PoC) is the first point at which the concept is tested to determine if it can be successfully deployed. The vendor with the greatest number of PoCs, trials, and testing scores the highest.

Energy Efficiency Commitments: Reducing energy consumption in the RAN has become a priority for mobile vendors and operators mainly due to the energy crisis, operational costs, and sustainability regulations. Using this criterion, ABI Research ranks mobile vendors based on their initiatives and commitments related to energy savings.

Brownfield Deployments: Considering Open RAN deployments in brownfield scenarios, the compatibility with existing infrastructure indicates the vendor's capability to provide CSPs with more flexible network deployment strategies and help expand its global footprint. Vendors with more brownfield deployments will score higher.

Published November 2023

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