

twimbit

White Paper

Open RAN fundamentals



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About Open RAN

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Benefits

Open RAN evolution

vRAN

Decouples software from hardware and virtualize part/full baseband units (BBUs) for cloud deployment, interfaces remain in the proprietary domain

Open RAN

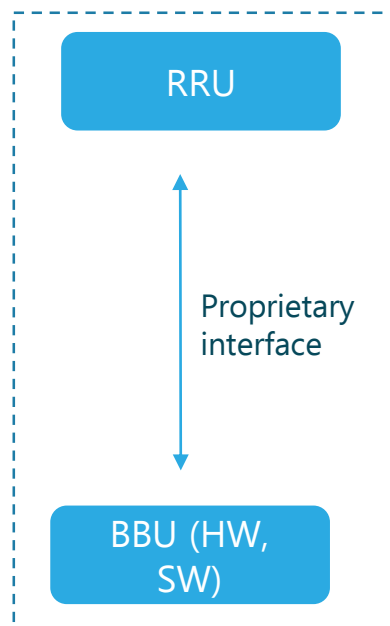
Open the transport interfaces between the different baseband processing functions and remote radio units (RRUs), network operators and equipment vendors can mix and match between units theoretically

Open vRAN

Combines of the two options (vRAN and Open RAN) for both open and virtualized baseband processing functions to maximize deployment flexibility and reduce time to market

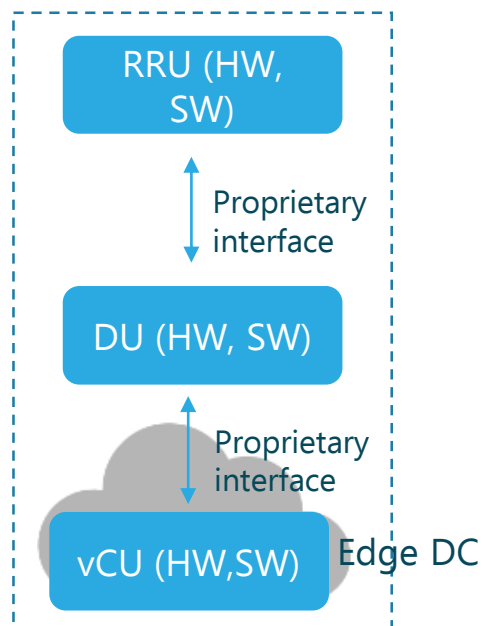
Open RAN architecture

Distributed RAN



Proprietary hardware
+
Proprietary software +
Proprietary interface

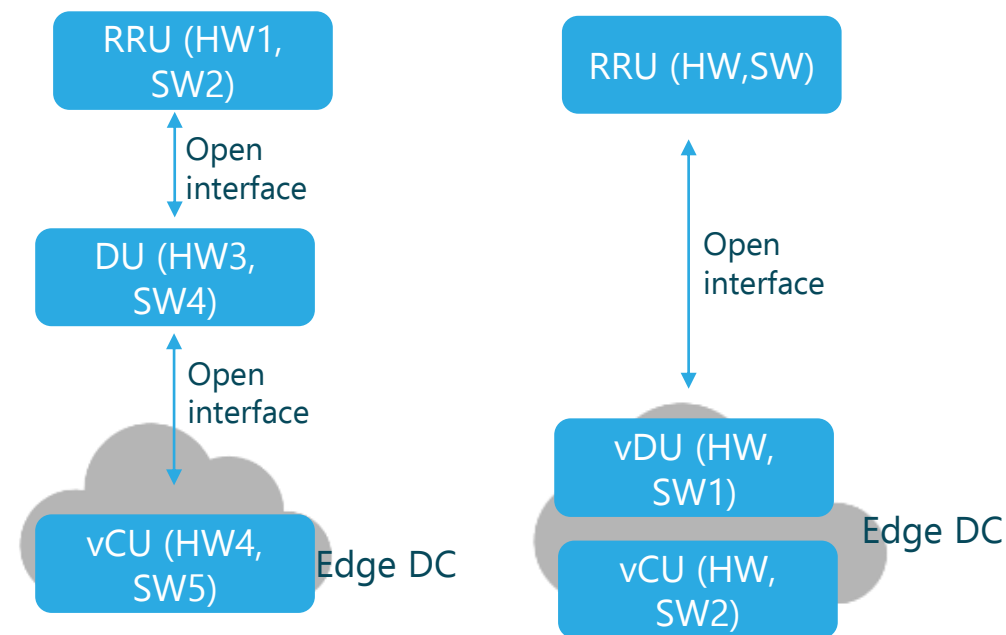
Cloud RAN/ vRAN



Proprietary hardware
+
Proprietary software +
Proprietary interface

Open RAN

Multiple vendors for RRU, DU, and CU



General purpose hardware + proprietary
software with virtualized functions + open
interface

Open RAN benefits



Vendor flexibility

- No vendor lock-in
- Increased competition
- Best of breed solutions for operators



Total cost of Ownership (TCO)

- Lower TCO
- Use of general-purpose hardware and commoditization of radio
- Network automation



Innovation

- Enabling robust applications
- Faster time to market
- New services and products

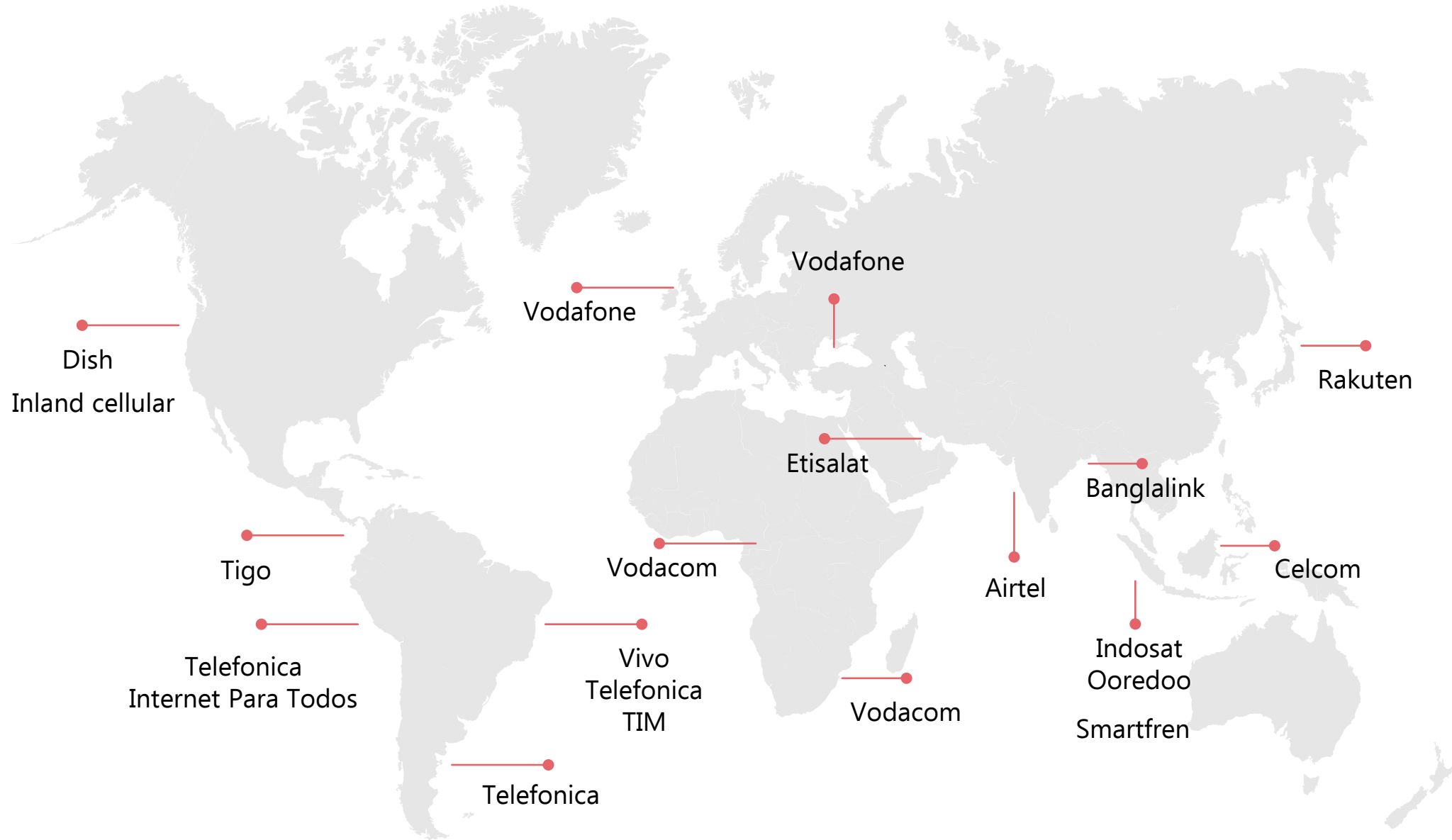
Current status of Open RAN

01 Deployments

02 Greenfield vs brownfield

03 Growth drivers

Open RAN deployments



Comparing greenfield and brownfield operators



Rakuten

Built fully virtualised, cloud native 5G RAN and core network functions on COTS



dish

Hosted an end-to-end, open & cloud-based 5G network on public infrastructure

VS



Telefónica

Engage in partnerships to launch pre-commercial trials in four core global markets

Has a target of reaching 50% radio network growth based on Open RAN by 2025



axiata

Conducted open RAN field pilots on legacy (2G & 3G) networks at rural sites

Open RAN growth drivers

Reasons

Disaggregated and virtualised networks

- Split or distributed architecture is a pre-requisite for 5G networks
- Open RAN will benefit from fast virtualisation of RAN

TCO optimisation & vendor flexibility

- Use of general purpose hardware and commoditization of radio
- Vendor diversity to break market monopolies

Rural deployment

- Bridging the digital divide by extending network coverage in rural areas is much easier for operators with the lower deployment cost of Open RAN

Government incentivisation

- **US:** Injected US\$ 750 million in funding over 10 years to accelerate the development of Open RAN solutions
- **UK:** Multiple grants released through OFCOM for open RAN lab, R&D, trials and deployment incentives
- **India:** The Indian government has encouraged local vendors to develop local telecom equipment supply chains under its "Make in India" incentives

Vendor landscape

01

Radio hardware

02

Radio software

03

System integrator

04

Semiconductor chips & components

Open RAN radio hardware

Radio units are built to common specifications that include common and open interfaces to other RAN elements

The logo for NEC, consisting of the letters "NEC" in a bold, blue, sans-serif font.The logo for KMW, consisting of the letters "KMW" in a bold, blue, sans-serif font.The logo for kontron, featuring a blue circular icon with white lines and the word "kontron" in a bold, black, sans-serif font.The logo for QCT, featuring a blue cloud icon with a yellow and green square and the letters "QCT" in a bold, blue, sans-serif font.The logo for NOKIA, consisting of the word "NOKIA" in a bold, blue, sans-serif font.The logo for FUJITSU, consisting of the word "FUJITSU" in a bold, red, sans-serif font with a red infinity symbol above the "i".The logo for Benetel, consisting of the word "Benetel" in a bold, red, sans-serif font.The logo for COMMSCOPE, consisting of the word "COMMSCOPE" in a bold, blue, sans-serif font with a blue globe icon.The logo for ip access, featuring the word "ip" in a bold, black, sans-serif font and "access" in a bold, blue, sans-serif font, with "a Mavenir company" in a smaller, black, sans-serif font below.The logo for AIRRAYS, featuring a blue bird-like icon above the word "AIRRAYS" in a bold, blue, sans-serif font.The logo for Comba, consisting of the word "Comba" in a bold, blue, sans-serif font.The logo for Bai Cells, featuring a red Wi-Fi signal icon above the word "Bai Cells" in a bold, blue, sans-serif font.The logo for Airspan, featuring a blue curved line icon above the word "Airspan" in a bold, blue, sans-serif font.The logo for twimbit, consisting of the word "twimbit" in a bold, blue, sans-serif font.

Open RAN radio software

Software is disaggregated to run on hardware from any supplier

More number of elements to be controlled and managed, making RIC and orchestration important

The logo for Mavenir, featuring the word "MAVENIR" in blue capital letters with a red underline under the letter "M".The logo for Altiostar, featuring the word "ALTIOSTAR" in blue capital letters with the tagline "Leading Network Transformation" in a smaller font below it.The logo for is-wireless, featuring a blue circular icon with a white signal wave and the text "is-wireless™" in black.The logo for Netcracker, featuring a blue stylized "N" icon and the text "Netcracker" in blue, with "An NEC Company" in a smaller font below it.The logo for Nokia, featuring the word "NOKIA" in blue capital letters.The logo for Ericsson, featuring three blue slanted bars above the word "ERICSSON" in blue capital letters.The logo for Acelleran, featuring the word "Acelleran" in blue with a stylized orange and blue "A" icon.The logo for VMware, featuring the word "vmware" in a lowercase, grey, sans-serif font with a registered trademark symbol.The logo for Parallel Wireless, featuring a green signal wave icon and the text "Parallel" in green and "WIRELESS" in orange below it.The logo for JMA, featuring the letters "JMA" in blue with a blue signal wave icon above the letter "A".The logo for Radisys, featuring a stylized red and black "R" icon and the word "adisys" in red.The logo for Samsung, featuring the word "SAMSUNG" in blue capital letters.The logo for twimbit, featuring the word "twimbit" in a lowercase, blue, sans-serif font.

Open RAN system integrator

Interoperability and performance are key factors

Traditionally integration was usually done by the RAN vendor, but in Open RAN the role of integrator is greatly enhanced

The logo for Accenture, featuring a purple chevron above the word "accenture" in a bold, black, sans-serif font.The logo for Altiostar, with the word "ALTIOSTAR" in blue, uppercase, sans-serif font, and the tagline "Leading Network Transformation" in a smaller, grey, italicized font below it.The logo for Tech Mahindra, with "Tech" in grey and "Mahindra" in red, both in a bold, sans-serif font.The logo for World Wide Technology, featuring a stylized "W" and "T" in red and blue above the text "World Wide Technology" in a black, sans-serif font.The logo for NEC, consisting of the letters "NEC" in a bold, blue, sans-serif font.The logo for Airspan, featuring a stylized blue arc above the word "Airspan" in a black, italicized, sans-serif font.The logo for IBM, consisting of the letters "IBM" in a blue, striped, sans-serif font.The logo for Mavenir, with the word "MAVENIR" in blue, uppercase, sans-serif font, and a red underline under the letter "A".The logo for Fujitsu, with the word "FUJITSU" in red, uppercase, sans-serif font, and a red infinity symbol above the letter "i".The logo for twimbit, with the word "twimbit" in a blue, lowercase, sans-serif font.

Open RAN semiconductor chips & components

Chip providers have a much greater opportunity to support equipment from multiple vendors



Concerns over **integration and performance** stand in the way of open RAN merits



Complex integration and interoperability challenge



Performance and feature parity



Legacy and backward compatibility



Secure, consistent network performance



Maintenance capabilities

Twimbit analysis

01

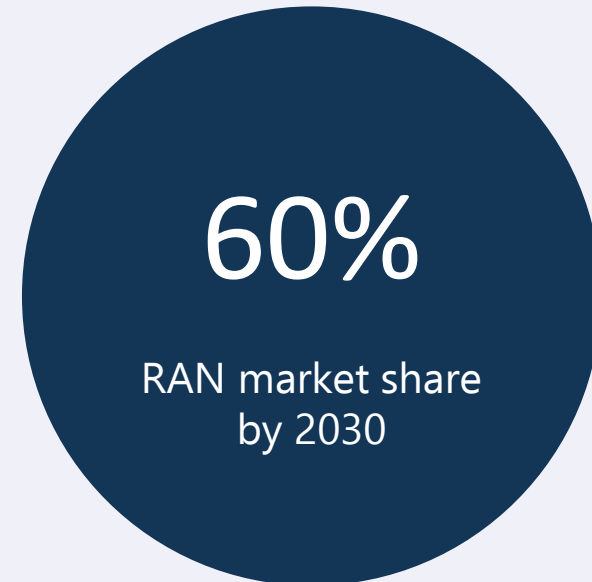
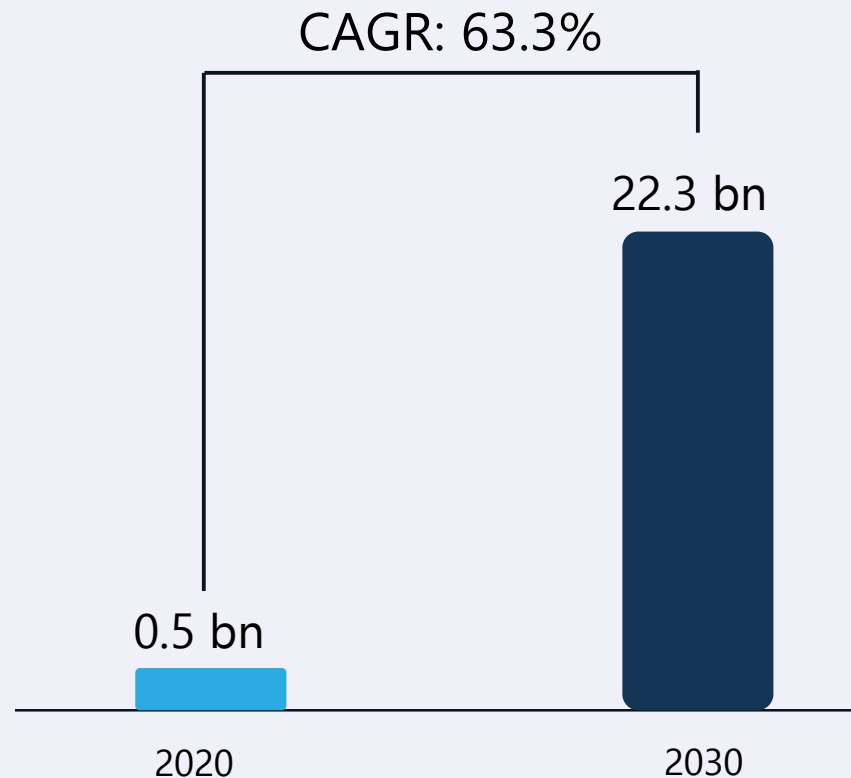
Analyst prediction

02

Key takeaways

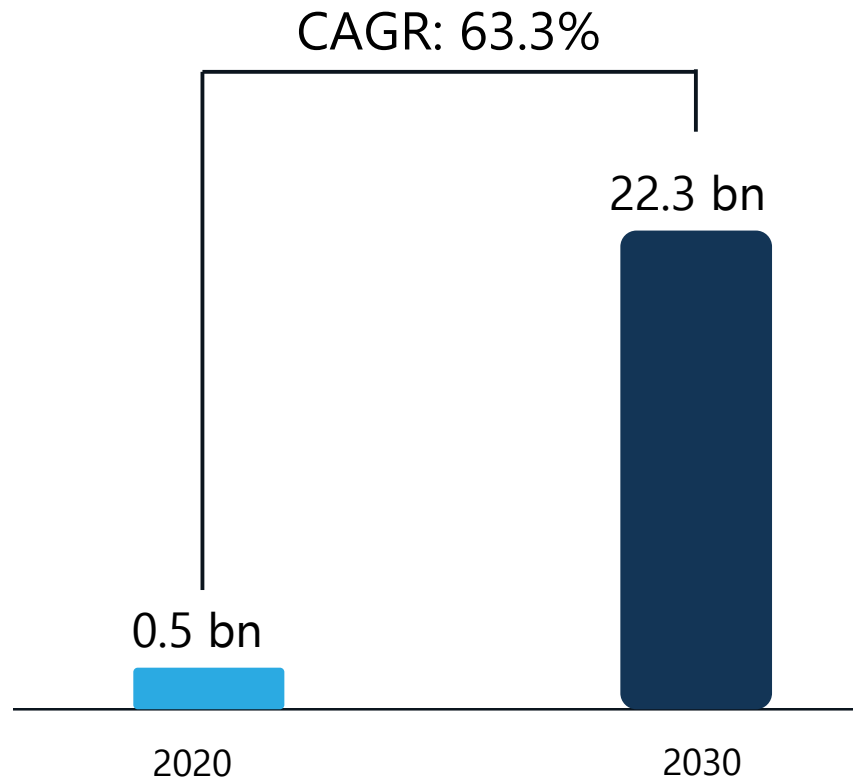
Open RAN market size

Global Open RAN Market Size, US\$ (Bn)
(2020 – 2030)



Open RAN market size

Global Open RAN Market Size, US\$ (Bn)
(2020 – 2030)



Inception growth of the Open RAN market is driven by **early adopters and deployment trials**

Market share remains low in the early stage. Mobile industry **sceptical of multiple complications** arising from multi-vendor structure

The penetration **forecasted to grow up to 3X from 2023 – 2027**. Momentum continues towards to end of the decade, where more than half of the total RAN market dominated by Open RAN



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