

The vRAN (Virtualized Radio Access Network) Ecosystem: 2017 – 2030 – Opportunities, Challenges, Strategies & Forecasts

https://marketpublishers.com/r/V9CB92CBFA3EN.html

Date: December 2016

Pages: 220

Price: US\$ 2,500.00 (Single User License)

ID: V9CB92CBFA3EN

Abstracts

vRAN (Virtualized Radio Access Network) refers to a RAN (Radio Access Network) implementation where some or all baseband functions are separated from the remote radio unit and run as VNFs (Virtualized Network Functions) on commodity hardware. This approach results in multiple operational benefits including but not limited to TCO (Total Cost of Ownership) reduction, performance gains and scalability. In addition, vRAN enables mobile operators to future-proof their networks for 5G upgrades.

The vRAN market is presently at a nascent stage with most investments focused on virtualized small cells for targeted greenfield deployments and pilot engagements for macrocell coverage. However, as mobile operators realize the benefits of RAN virtualization, the market is expected to grow at a CAGR of approximately 125% over the next three year period. By the end of 2020, SNS Research estimates that vRAN deployments will account for a market worth \$2.6 Billion.

The "vRAN (Virtualized Radio Access Network) Ecosystem: 2017 – 2030 – Opportunities, Challenges, Strategies & Forecasts" report presents an in-depth assessment of the vRAN ecosystem including enabling technologies, key trends, market drivers, challenges, standardization, collaborative initiatives, regulatory landscape, deployment models, operator case studies, opportunities, future roadmap, value chain, ecosystem player profiles and strategies. The report also presents forecasts for vRAN investments from 2017 till 2030. The forecasts cover multiple submarkets and 6 regions.

The report comes with an associated Excel datasheet suite covering quantitative data from all numeric forecasts presented in the report.



Contents

1 CHAPTER 1: INTRODUCTION

- 1.1 Executive Summary
- 1.2 Topics Covered
- 1.3 Forecast Segmentation
- 1.4 Key Questions Answered
- 1.5 Key Findings
- 1.6 Methodology
- 1.7 Target Audience
- 1.8 Companies & Organizations Mentioned

2 CHAPTER 2: AN OVERVIEW OF VRAN

- 2.1 C-RAN (Centralized Radio Access Network): Opening the Door to RAN Virtualization
 - 2.1.1 Decoupling the Base Station
 - 2.1.2 Brief History
 - 2.1.3 Outlook on Future Investments
- 2.2 What is vRAN?
 - 2.2.1 Leveraging Commodity Technologies
 - 2.2.2 Moving RAN to the Cloud
- 2.3 Key Functional Elements of vRAN
 - 2.3.1 Remote Radio Unit
 - 2.3.2 vBBU (Virtualized Baseband Unit)
 - 2.3.2.1 Baseband VNFs (Virtualized Network Functions)
 - 2.3.2.2 RTOS (Real-Time Operating System) & Virtualization Environment
 - 2.3.2.3 GPP (General Purpose Processor) Platform
 - 2.3.2.4 Dedicated Programmable Hardware
 - 2.3.2.5 External Interactions
 - 2.3.3 Fronthaul
 - 2.3.3.1 Technologies
 - 2.3.3.2 Interface Options
- 2.4 Baseband Functional Split Approaches
- 2.4.1 Fully Virtualized Baseband Processing: PHY-RF Split
- 2.4.2 Partially Virtualized Functional Splits
 - 2.4.2.1 Intra-PHY Split
 - 2.4.2.2 MAC-PHY Split



- 2.4.2.3 Intra-MAC Split
- 2.4.2.4 RLC-MAC Split
- 2.4.2.5 Intra-RLC Split
- 2.4.2.6 PDCP-RLC Split
- 2.4.2.7 RRC-PDCP Split
- 2.5 Market Growth Drivers
 - 2.5.1 Capacity & Coverage Improvement: Addressing the Mobile Data Traffic Tsunami
 - 2.5.2 Bringing Intelligence to the Edge: MEC (Mobile Edge Computing)
 - 2.5.3 OpEx Reduction: Reducing Energy & Maintenance Costs
 - 2.5.4 CapEx Reduction: BBU Resource Pooling & Commodity IT Hardware
 - 2.5.5 Agile & Flexible Network Architecture
 - 2.5.6 Enhanced Support for Advanced RAN Coordination Features
 - 2.5.7 Multi-Tenancy & RAN Sharing
 - 2.5.8 Enabling Painless Migration Towards Future RAN Technologies
 - 2.5.9 Impact of 5G Rollouts
- 2.6 Market Barriers
 - 2.6.1 Fronthaul Investments
 - 2.6.2 Virtualization Challenges
 - 2.6.3 Vendor Proprietary Functional Splits
 - 2.6.4 Migration from Legacy Architectures

3 CHAPTER 3: STANDARDIZATION, REGULATORY & COLLABORATIVE INITIATIVES

- 3.1 3GPP (3rd Generation Partnership Project)
 - 3.1.1 Functional Splits for vRAN Implementation in 5G Networks
 - 3.1.2 Management of Virtualized Mobile Networks
- 3.2 Broadband Forum
 - 3.2.1 TR-069 for PNF Management
- 3.3 CPRI Initiative
 - 3.3.1 eCPRI for 5G Fronthaul Networks
- 3.4 ETSI (European Telecommunications Standards Institute)
 - 3.4.1 ORI for Fronthaul
 - 3.4.2 NFV (Network Functions Virtualization) for vRAN
 - 3.4.3 MEC (Mobile Edge Computing)
- 3.5 IEEE (Institute of Electrical and Electronics Engineers)
 - 3.5.1 IEEE 802.1CM: TSN (Time-Sensitive Networking) for Fronthaul
- 3.5.2 IEEE P1904.3: Standard for RoE (Radio over Ethernet) Encapsulations and Mappings



- 3.5.3 IEEE 1914: NGFI (Next Generation Fronthaul Interface) Working Group
- 3.5.4 Other Standards & Work Groups
- 3.6 ITU (International Telecommunications Union)
 - 3.6.1 Focus Group on IMT-2020
- 3.7 MEF (Metro Ethernet Forum)
 - 3.7.1 Ethernet Transport
- 3.8 NGMN (Next Generation Mobile Networks) Alliance
 - 3.8.1 P-CRAN (Project Centralized RAN)
- 3.9 ONF (Open Networking Foundation) & ON.Lab (Open Networking Lab)
 - 3.9.1 M-CORD (Mobile Central Office Re-architected as a Datacenter)
- 3.10 OSA (OpenAirInterface Software Alliance)
 - 3.10.1 LTE vRAN Implementation
- 3.11 SCF (Small Cell Forum)
 - 3.11.1 Release 8: Small Cell Virtualization with nFAPI
- 3.12 TIP (Telecom Infra Project)
 - 3.12.1 OpenCellular Access Platform
- 3.13 xRAN Consortium
 - 3.13.1 xRAN Architecture

4 CHAPTER 4: VRAN DEPLOYMENT MODELS & CASE STUDIES

- 4.1 Deployment Models
 - 4.1.1 Distributed vRAN
 - 4.1.2 Centralized vRAN: Cloud RAN
 - 4.1.3 Virtualized Small Cells
- 4.2 Mobile Operator Case Studies
 - 4.2.1 BT Group
 - 4.2.2 China Mobile
 - 4.2.3 China Unicom
 - 4.2.4 KT Corporation
 - 4.2.5 NTT DoCoMo
 - 4.2.6 Orange
 - 4.2.7 SK Telecom
 - 4.2.8 SoftBank Group
 - 4.2.9 Telefonica Group
 - 4.2.10 TIM (Telecom Italia Mobile)
 - 4.2.11 Vodafone Group

5 CHAPTER 5: VRAN INDUSTRY ROADMAP & VALUE CHAIN



5.1 Industry Roadmap

- 5.1.1 2017 2020: Growing Adoption of Virtualized Small Cells
- 5.1.2 2020 2025: The Cloud RAN Era Moving vRAN to the Data Center
- 5.1.3 2025 2030: Continued Investments with 5G Network Rollouts
- 5.2 Value Chain
 - 5.2.1 Enabling Technology Providers
 - 5.2.2 Radio Equipment Suppliers
 - 5.2.3 vBBU Vendors
 - 5.2.4 Fronthaul Networking Vendors
 - 5.2.5 Mobile Operators
 - 5.2.6 Test, Measurement & Performance Specialists

6 CHAPTER 6: KEY MARKET PLAYERS

- **6.1 6WIND**
- 6.2 ADLINK Technology
- 6.3 Advantech
- 6.4 Airspan Networks
- 6.5 Altiostar Networks
- 6.6 Amarisoft
- 6.7 Argela
- 6.8 Aricent
- 6.9 ARM Holdings
- 6.10 Artemis Networks
- 6.11 Artesyn Embedded Technologies
- **6.12 ASOCS**
- 6.13 ASTRI (Hong Kong Applied Science and Technology Research Institute)
- 6.14 Broadcom
- 6.15 Casa Systems
- 6.16 Cavium
- 6.17 Cisco Systems
- 6.18 Clavister
- 6.19 Cobham Wireless
- 6.20 Comcores
- 6.21 CommAgility
- 6.22 CommScope
- 6.23 Contela
- 6.24 Dali Wireless



- 6.25 Dell Technologies
- 6.26 eASIC Corporation
- 6.27 Ericsson
- 6.28 Facebook
- 6.29 Fujitsu
- 6.30 Hitachi
- 6.31 HPE (Hewlett Packard Enterprise)
- 6.32 Huawei
- 6.33 IBM Corporation
- 6.34 IDT (Integrated Device Technology)
- 6.35 Intel Corporation
- 6.36 ip.access
- 6.37 IS-Wireless
- 6.38 JMA Wireless
- 6.39 Kathrein-Werke KG
- 6.40 Mellanox Technologies
- 6.41 Microsemi Corporation
- 6.42 Mobiveil
- 6.43 MTI Mobile
- 6.44 NEC Corporation
- 6.45 Nokia
- 6.46 NXP Semiconductors
- 6.47 Octasic
- 6.48 Parallel Wireless
- 6.49 Phluido
- 6.50 Qualcomm
- 6.51 Quortus
- 6.52 Radisys Corporation
- 6.53 Red Hat
- 6.54 Samsung Electronics
- 6.55 SOLiD (SOLiD Technologies)
- 6.56 SpiderCloud Wireless
- 6.57 Sumitomo Electric Industries
- 6.58 Sunnada (Fujian Sunnada Communication Company)
- 6.59 Sunwave Communications
- 6.60 TI (Texas Instruments)
- 6.61 Xilinx
- 6.62 Xura
- 6.63 ZTE



7 CHAPTER 7: MARKET ANALYSIS & FORECASTS

- 7.1 Global Outlook on vRAN Investments
- 7.2 Segmentation by Deployment Model
 - 7.2.1 Virtualized Small Cells
 - 7.2.2 Virtualized Macrocells
- 7.3 Segmentation by Air Interface Technology
 - 7.3.1 LTE & 3G
 - 7.3.2 5G NR (New Radio)
- 7.4 Segmentation by Submarket
 - 7.4.1 vRAN Radio Units
 - 7.4.1.1 Virtualized Small Cell Radio Units
 - 7.4.1.2 Virtualized Macrocell Radio Units
 - 7.4.2 vBBUs (Virtualized Baseband Units)
 - 7.4.2.1 Virtualized Small Cell BBUs
 - 7.4.2.2 Virtualized Macrocell BBUs
- 7.5 Segmentation by Region
 - 7.5.1 vRAN Radio Units
 - 7.5.2 vBBUs
- 7.6 Asia Pacific
 - 7.6.1 vRAN Radio Units
 - 7.6.2 vBBUs
- 7.7 Eastern Europe
 - 7.7.1 vRAN Radio Units
 - 7.7.2 vBBUs
- 7.8 Middle East & Africa
 - 7.8.1 vRAN Radio Units
 - 7.8.2 vBBUs
- 7.9 Latin & Central America
 - 7.9.1 vRAN Radio Units
 - 7.9.2 vBBUs
- 7.10 North America
 - 7.10.1 vRAN Radio Units
 - 7.10.2 vBBUs
- 7.11 Western Europe
 - 7.11.1 vRAN Radio Units
 - 7.11.2 vBBUs



8 CHAPTER 8: EXPERT OPINION – INTERVIEW TRANSCRIPTS

- 8.1 Ericsson
- 8.2 Nokia Networks
- 8.3 ASOCS
- 8.4 SpiderCloud Wireless
- 8.5 Parallel Wireless

9 CHAPTER 9: CONCLUSION & STRATEGIC RECOMMENDATIONS

- 9.1 Why is the Market Poised to Grow?
- 9.2 Competitive Industry Landscape: Acquisitions, Alliances & Consolidation
- 9.3 Is Centralization a Pre-Requisite for vRAN Implementation?
- 9.4 Setting the Foundation for 5G NR (New Radio) Upgrades
- 9.5 What is the Cost Saving Potential of vRAN?
- 9.6 Integration with MEC (Mobile Edge Computing)
- 9.7 Moving Towards a Cloud Operating Model
- 9.8 Prospects of Neutral Hosting with vRAN
- 9.9 Enabling RAN Slicing
- 9.10 Unlicensed Spectrum: Impact on Virtualized Small Cell Design
- 9.11 Geographic Outlook: Which Countries Offer the Highest Growth Potential?
- 9.12 Strategic Recommendations
 - 9.12.1 vRAN Solution Providers
 - 9.12.2 Mobile Operators



List Of Figures

LIST OF FIGURES

Figure 1: C-RAN Architecture

Figure 2: vRAN Architecture

Figure 3: Key Remote Radio Unit & vBBU Functions

Figure 4: VM vs. Container Virtualization

Figure 5: CPRI Protocol Layers

Figure 6: Baseband Functional Split Options for vRAN

Figure 7: Examples of Maximum Required Bitrate on a Fronthaul Link for Possible PHY-

RF Split

Figure 8: Performance Comparison of Baseband Functional Split Options for vRAN

Figure 9: Annual Global Throughput of Mobile Network Data Traffic by Region: 2017 –

2030 (Exabytes)

Figure 10: ETSI NFV Architecture

Figure 11: M-CORD Focus Areas

Figure 12: nFAPI Interfaces

Figure 13: Distributed vRAN Deployment Model

Figure 14: Cloud RAN Deployment Model

Figure 15: Virtualized Small Cell Deployment Model

Figure 16: China Mobile's Cloud RAN Vision

Figure 17: NTT DoCoMo's Advanced C-RAN Architecture

Figure 18: SK Telecom's SDRAN (Software Defined RAN) Architecture

Figure 19: SoftBank's Virtualized Small Cell Trial

Figure 20: vRAN Industry Roadmap

Figure 21: vRAN Value Chain

Figure 22: Global vRAN Revenue: 2017 – 2030 (\$ Million)

Figure 23: Global vRAN Revenue by Deployment Model: 2017 – 2030 (\$ Million)

Figure 24: Global Virtualized Small Cell RAN Revenue: 2017 – 2030 (\$ Million)

Figure 25: Global Virtualized Macrocell RAN Revenue: 2017 – 2030 (\$ Million)

Figure 26: Global vRAN Revenue by Air Interface Technology: 2017 – 2030 (\$ Million)

Figure 27: Global Virtualized LTE & 3G RAN Revenue: 2017 – 2030 (\$ Million)

Figure 28: Global Virtualized 5G NR RAN Revenue: 2017 – 2030 (\$ Million)

Figure 29: Global vRAN Revenue by Submarket: 2016 - 2030 (\$ Million)

Figure 30: Global vRAN Radio Unit Shipments: 2017 – 2030 (Thousands of Units)

Figure 31: Global vRAN Radio Unit Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 32: Global vRAN Radio Unit Shipments by Deployment Model: 2017 – 2030

(Units)



- Figure 33: Global vRAN Radio Unit Shipment Revenue by Deployment Model: 2017 2030 (\$ Million)
- Figure 34: Global Virtualized Small Cell Radio Unit Shipments: 2017 2030 (Units)
- Figure 35: Global Virtualized Small Cell Radio Unit Shipment Revenue: 2017 2030 (\$ Million)
- Figure 36: Global Virtualized Macrocell Radio Unit Shipments: 2017 2030 (Units)
- Figure 37: Global Virtualized Macrocell Radio Unit Shipment Revenue: 2017 2030 (\$ Million)
- Figure 38: Global vBBU Shipments: 2017 2030 (Units)
- Figure 39: Global vBBU Shipment Revenue: 2017 2030 (\$ Million)
- Figure 40: Global vBBU Shipments by Deployment Model: 2017 2030 (Units)
- Figure 41: Global vBBU Shipment Revenue by Deployment Model: 2017 2030 (\$ Million)
- Figure 42: Global Virtualized Small Cell BBU Shipments: 2017 2030 (Units)
- Figure 43: Global Virtualized Small Cell BBU Shipment Revenue: 2017 2030 (\$ Million)
- Figure 44: Global Virtualized Macrocell BBU Shipments: 2017 2030 (Units)
- Figure 45: Global Virtualized Macrocell BBU Shipment Revenue: 2017 2030 (\$ Million)
- Figure 46: vRAN Revenue by Region: 2017 2030 (\$ Million)
- Figure 47: vRAN Radio Unit Shipments by Region: 2017 2030 (Thousands of Units)
- Figure 48: vRAN Radio Unit Shipment Revenue by Region: 2017 2030 (\$ Million)
- Figure 49: vBBU Shipments by Region: 2017 2030 (Units)
- Figure 50: vBBU Shipment Revenue by Region: 2017 2030 (\$ Million)
- Figure 51: Asia Pacific vRAN Revenue: 2017 2030 (\$ Million)
- Figure 52: Asia Pacific vRAN Radio Unit Shipments: 2017 2030 (Thousands of Units)
- Figure 53: Asia Pacific vRAN Radio Unit Shipment Revenue: 2017 2030 (\$ Million)
- Figure 54: Asia Pacific vBBU Shipments: 2017 2030 (Units)
- Figure 55: Asia Pacific vBBU Shipment Revenue: 2017 2030 (\$ Million)
- Figure 56: Eastern Europe vRAN Revenue: 2017 2030 (\$ Million)
- Figure 57: Eastern Europe vRAN Radio Unit Shipments: 2017 2030 (Thousands of Units)
- Figure 58: Eastern Europe vRAN Radio Unit Shipment Revenue: 2017 2030 (\$ Million)
- Figure 59: Eastern Europe vBBU Shipments: 2017 2030 (Units)
- Figure 60: Eastern Europe vBBU Shipment Revenue: 2017 2030 (\$ Million)
- Figure 61: Middle East & Africa vRAN Revenue: 2017 2030 (\$ Million)
- Figure 62: Middle East & Africa vRAN Radio Unit Shipments: 2017 2030 (Thousands of Units)
- Figure 63: Middle East & Africa vRAN Radio Unit Shipment Revenue: 2017 2030 (\$



Million)

Figure 64: Middle East & Africa vBBU Shipments: 2017 – 2030 (Units)

Figure 65: Middle East & Africa vBBU Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 66: Latin & Central America vRAN Revenue: 2017 – 2030 (\$ Million)

Figure 67: Latin & Central America vRAN Radio Unit Shipments: 2017 – 2030

(Thousands of Units)

Figure 68: Latin & Central America vRAN Radio Unit Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 69: Latin & Central America vBBU Shipments: 2017 – 2030 (Units)

Figure 70: Latin & Central America vBBU Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 71: North America vRAN Revenue: 2017 – 2030 (\$ Million)

Figure 72: North America vRAN Radio Unit Shipments: 2017 – 2030 (Thousands of Units)

Figure 73: North America vRAN Radio Unit Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 74: North America vBBU Shipments: 2017 – 2030 (Units)

Figure 75: North America vBBU Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 76: Western Europe vRAN Revenue: 2017 – 2030 (\$ Million)

Figure 77: Western Europe vRAN Radio Unit Shipments: 2017 – 2030 (Thousands of Units)

Figure 78: Western Europe vRAN Radio Unit Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 79: Western Europe vBBU Shipments: 2017 – 2030 (Units)

Figure 80: Western Europe vBBU Shipment Revenue: 2017 – 2030 (\$ Million)

Figure 81: Centralization & Virtualization of RAN Functions

Figure 82: Centralized vs. Distributed Cloud RAN Architecture

Figure 83: Nokia's Cloud Based Radio Architecture

Figure 84: TCO Comparison Between vRAN and Conventional RAN Architecture (\$ per GB)

Figure 85: Conceptual Architecture for Network Slicing in Mobile Networks

Figure 86: nFAPI support for LAA's LBT Functionality

LIST OF COMPANIES MENTIONED

3GPP (3rd Generation Partnership Project)

6WIND

ADLINK Technology

Advantech

Airspan Networks

Altiostar Networks



Amarisoft

Argela

Aricent

ARM Holdings

Artemis Networks

Artesyn Embedded Technologies

ASOCS

ASTRI (Hong Kong Applied Science and Technology Research Institute)

Broadband Forum

Broadcom

BT Group

Casa Systems

Cavium

China Mobile

China Unicom

Cisco Systems

Clavister

Cobham Wireless

Comcores

CommAgility

CommScope

Contela

Dali Wireless

Dell Technologies

DT (Deutsche Telekom)

eASIC Corporation

EBlink

ΕE

Ericsson

ETSI (European Telecommunications Standards Institute)

EURECOM

Facebook

Fujitsu

Hitachi

HPE (Hewlett Packard Enterprise)

Huawei

IBM Corporation

IDT (Integrated Device Technology)

IEEE (Institute of Electrical and Electronics Engineers)



Intel Corporation

ip.access

IS-Wireless

ITU (International Telecommunications Union)

JMA Wireless

Kathrein-Werke KG

KT Corporation

Linux Foundation

MEF (Metro Ethernet Forum)

Mellanox Technologies

Microsemi Corporation

Mitel Mobility

Mobiveil

MontaVista Software

MTI Mobile

NEC Corporation

NGMN (Next Generation Mobile Networks) Alliance

Nokia

Nokia Networks

Nokia Technologies

NTT Communications

NTT DoCoMo

NXP Semiconductors

Octasic

ON.Lab (Open Networking Lab)

ONF (Open Networking Foundation)

Orange

OSA (OpenAirInterface Software Alliance)

Parallel Wireless

Phluido

Qualcomm

Quortus

Radisys Corporation

Ranzure Networks

Rearden

Red Hat

Samsung Electronics

SCF (Small Cell Forum)

SK Telecom



SoftBank Group

SOLiD (SOLiD Technologies)

SpiderCloud Wireless

Sprint Corporation

Sumitomo Electric Industries

Sunnada (Fujian Sunnada Communication Company)

Sunwave Communications

Telecom Italia Group

Telefonica Group

TI (Texas Instruments)

TIM (Telecom Italia Mobile)

Vodafone Group

Vodafone Hutchison Australia

Vodafone Italy

Xilinx

xRAN Consortium

Xura

ZTE



I would like to order

Product name: The vRAN (Virtualized Radio Access Network) Ecosystem: 2017 - 2030 - Opportunities,

Challenges, Strategies & Forecasts

Product link: https://marketpublishers.com/r/V9CB92CBFA3EN.html

Price: US\$ 2,500.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer

Service:

info@marketpublishers.com

Payment

First name:

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page https://marketpublishers.com/r/V9CB92CBFA3EN.html

To pay by Wire Transfer, please, fill in your contact details in the form below:

Last name:	
Email:	
Company:	
Address:	
City:	
Zip code:	
Country:	
Tel:	
Fax:	
Your message:	
	**All fields are required
	Custumer signature

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at https://marketpublishers.com/docs/terms.html

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970

