Opportunities 5G and Make in India

Kaustubha Parkhi
Principal Analyst – Insight Research

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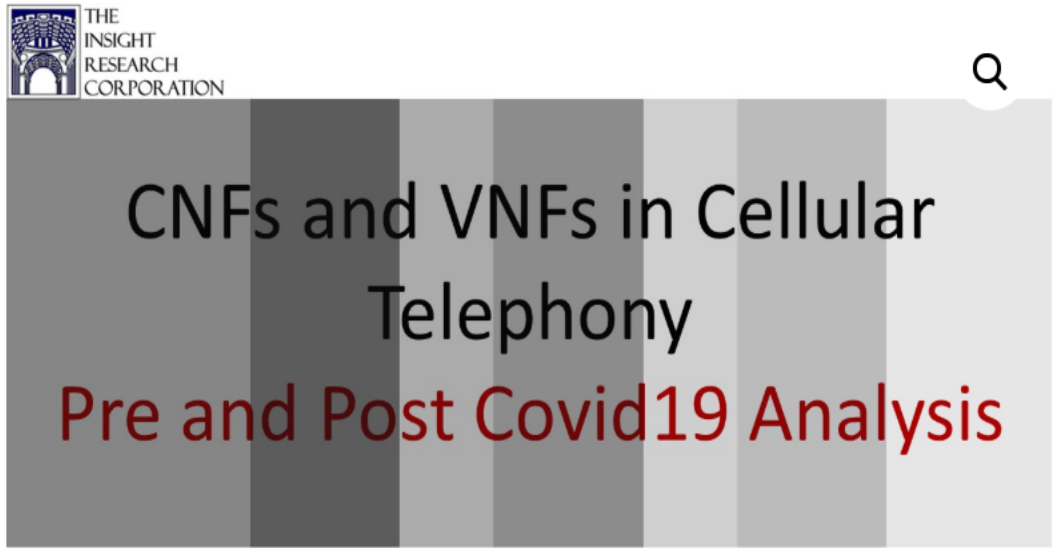
Words of Wisdom

Not being ready can convert an opportunity into a challenge

While

Being ready can convert a challenge into an opportunity

--Common Sense



CNFs and VNFs in Cellular Telephony: Pre and Post Covid19 Analysis

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About Insight Research

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Unwavering focus on Telecommunications

2016
Bengaluru
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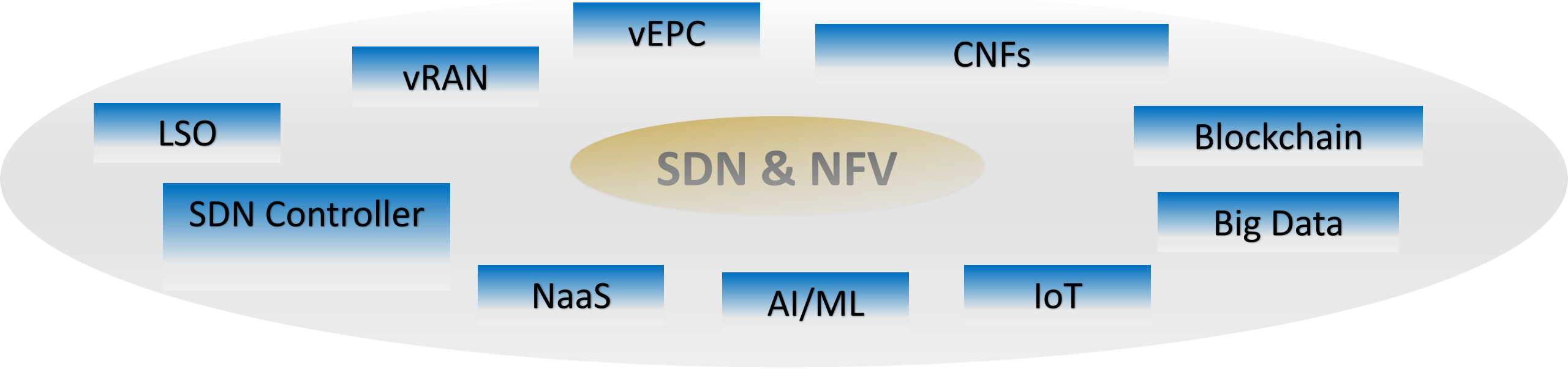
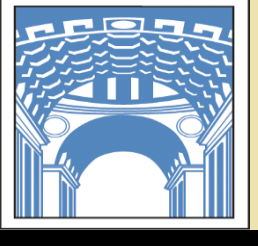


Reliance Jio to launch 'Made in In

indianexpress.com/article/technology/tech-news-technology/reliance-jio-to-launch-made-in-india-5g-network-mukesh-ambani-6506961/

Yes,
Yes
and Yes



Say Hello to CNFs, or Cloud-Native Network Functions

"We are more scalable than these vendors and are fully automated since we have our own **cloud-native platform**. In 5G, we will totally be self-sufficient"

Unnamed Jio Executive, The Economic Times

Containers and Microservices

Docker, considered as the creator of containers, defines containers as "***a standard unit of software that packages up code and all its dependencies, so the application runs quickly and reliably from one computing environment to another***". A container image thus includes the system tools and libraries apart from runtime, settings and the code itself.

An equally, if not more important, is the construct of microservices. **Microservices dissect and granularize applications to a very fine degree. Microservices transform the application structure from a monolith to a collection of logical functions. Each microservice runs independently of each other.**

Microservices Challenges

- While they reduce the size of individual service strands and the all the development and similar overheads associated with it; microservices tend to multiply in their quest for modularity, making it **extremely challenging for administrators** to keep track of them.
- Microservices **contribute to latency**. Summoning individual microservices requires the architecture to initiate network calls. Microservices-driven architecture can eventually turn out to be slower than a robustly designed monolithic application.
- The lure of multiple microservices sometimes entices system designers into building multiple routes or pathways for the application to run. While redundancy of resources and diversity in approaches are largely welcome, these plentiful options creates its own **tracking and monitoring challenges.**
- The resource utilization efficiency of microservices is scenario specific. At full capacity, microservice-driven architecture often **consumes more resources** as compared to a monolithic application designed for similar purposes.

CNFs are integral to the 5G network framework

- In July 2018, the 5G-PPP published a whitepaper outlining its vision for the journey of **cloud native infrastructure** from **conventional web-scale applications** to the **more demanding telco environments**.
- The PPP recommended leveraging of **microservices and service-based architecture (SBA)** to execute the seamless progression of cloud native constructs into the 5G-telco infrastructure.
- **Service-based architecture (SBA)** is effective in ensuring the agile design and execution of 5G networks.

Why is this important?

5G is different!

5G technology factors the presence of multiple usage scenarios as defined by ITU-R Recommendation M.2083-0

- Enhanced mobile broadband (eMBB) for multimedia content accessed by **human users**
- Massive machine type communications (MMTC) for machines and sensors transmitting low throughput data that is **not delay-sensitive**; mainly IoT
- Ultra-reliable and low-latency communications (URLLC) for **highly latency-sensitive and bandwidth intensive** applications in the areas of medicine, transportation and industrial applications; including IoT

This requires flexible NFs

5G Complexities - I; NGFI

- (IEEE) has proposed the bifurcation of the stretch between the broadband unit (BBU) located centrally and the radio resource unit (RRU) collocated at the antenna sites.
- The BBU-RRU stretch will be punctuated with a distributor unit (DU).
- The two hops thus formed will be labelled next-generation fronthaul interfaces (NGFI). The RU-DU hop will be denoted by NGFI-I, while the DU-CU hop will be denoted by NGFI-II.
- This requires flexible NFs
- A new Ethernet input queue (IQ) frame structure is being developed to cater to the diverse demands of the varied NGFIs. Other enhancements include a new air interface known as new radio (NR). Migration to NR is poised to be in either phased manner (user plane alone based on NR, while control plane retained with LTE) or in complete independence with LTE network (user plane and control plane, both based on NR).

5G Complexities – II; Millimeter wave

- The pressure on 3GPP can be gauged from the fact that the body had to settle for an early initial release (Release 15) in March 2019 just to accommodate the early roll-outs spearheaded by ambitious telcos.
- The more detailed Release 16, which will arrogate the status of an IMT-2020 technology on 5G, was concluded only in July 2020.
- 5G [illegible] eyeing lower frequency [illegible] pressure on spectrum availability.
- The full-blown flavor of 5G will be available in the coveted millimeter wave band exceeding 24 GHz, wherein 5G is expected to herald download throughput in the range of 20 Gbps – an improvement of several multiples over 4G-LTE.

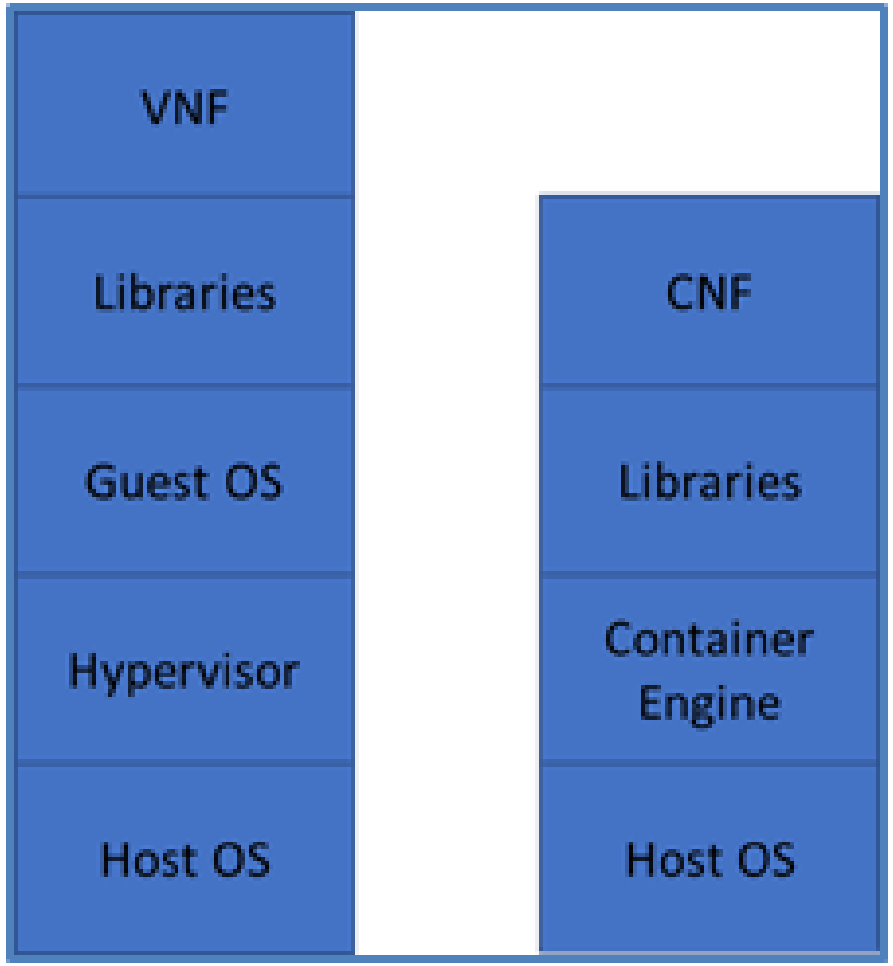
This requires flexible NFs

5G Complexities – III; SA and NSA

- The 5G base station is called gNB. gNB leverages MIMO to the next level by using distributed and uncorrelated spatial location of the various users. gNB is thus said to be employing multiuser (MU) MIMO.
- Migration to NR is poised to be in either phased manner **(user plane alone based on NR, while control plane retained with LTE)** or in complete independence with **LTE network (user plane and control**
- with
- The former is called the **non-standalone (NSA) mode**, while the latter is called the **standalone (SA) mode**. NSA mode features FDD spectrum sharing at the network level, and dynamic spectrum sharing (DSS) at the 4G LTE UE – NR terminal level.
- It should be understood that the **URLLC and MMTC can be actualized only with the SA-5GC** combination.

This requires flexible NFs

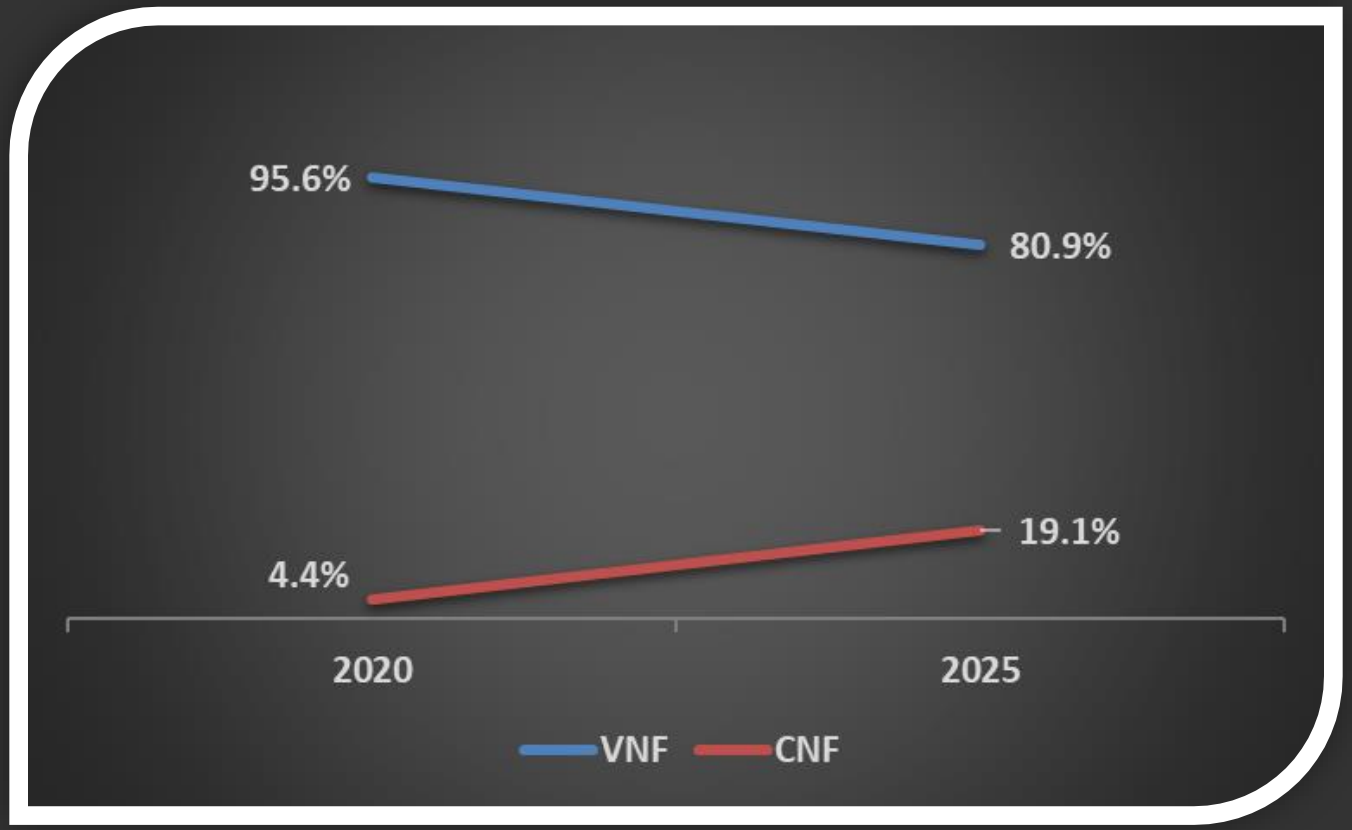
The modern-day NF is decoupled, not homogenous



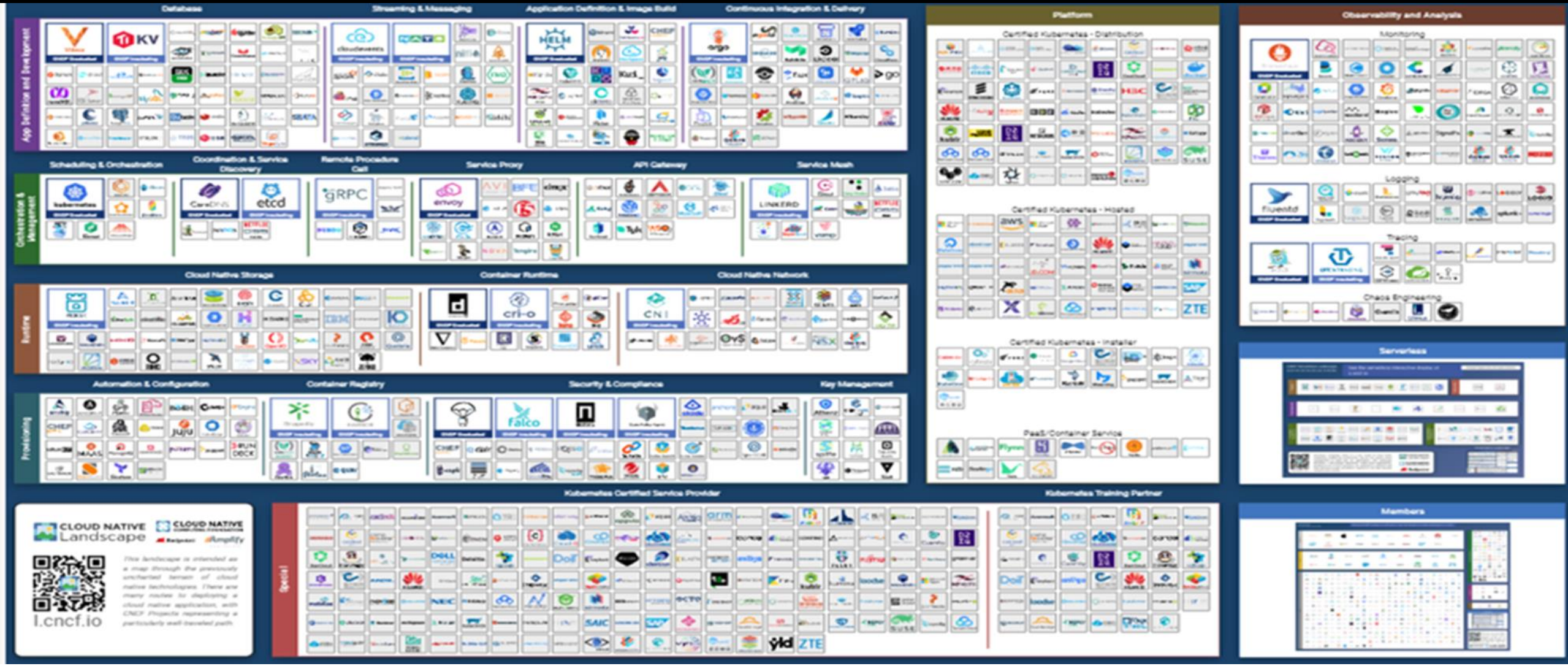
Advantage CNFs

- Freedom from Hypervisors
- File-level Resource Management
- Portability
- Microservices-powered Scalability and Granularity
- Quick Operationalization
- Quick Orchestration

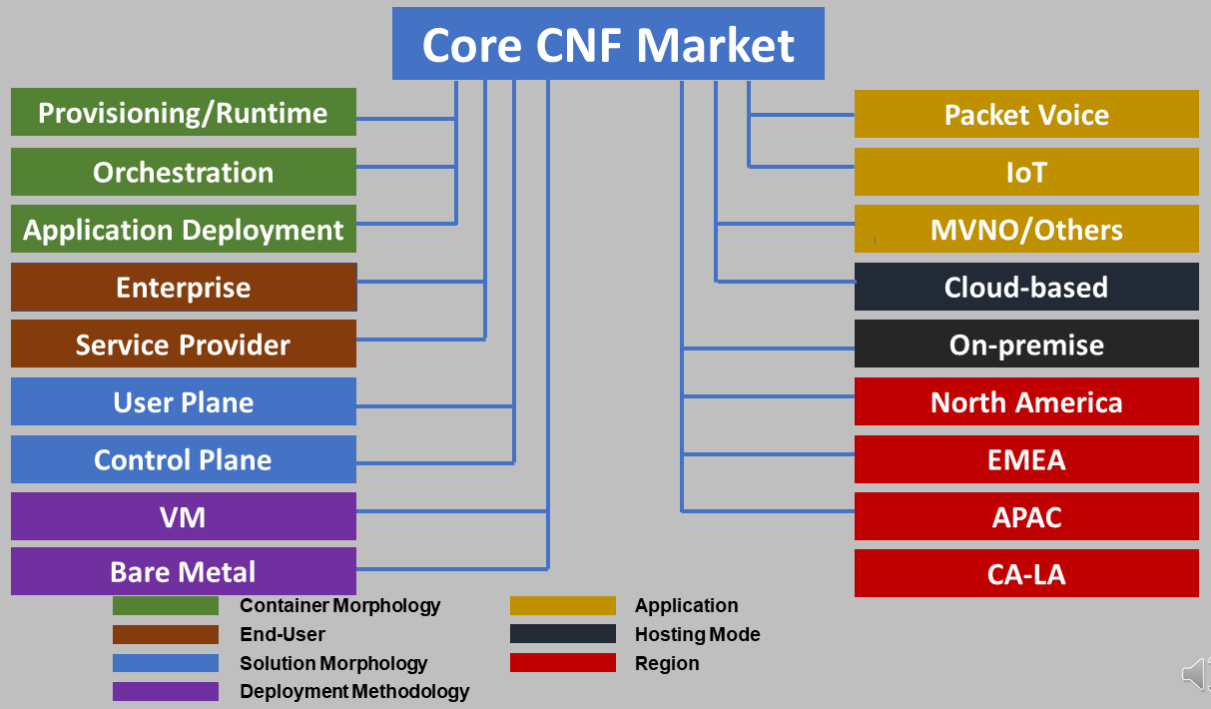
CNFs will Outpace VNFs Comprehensively in Core and RAN

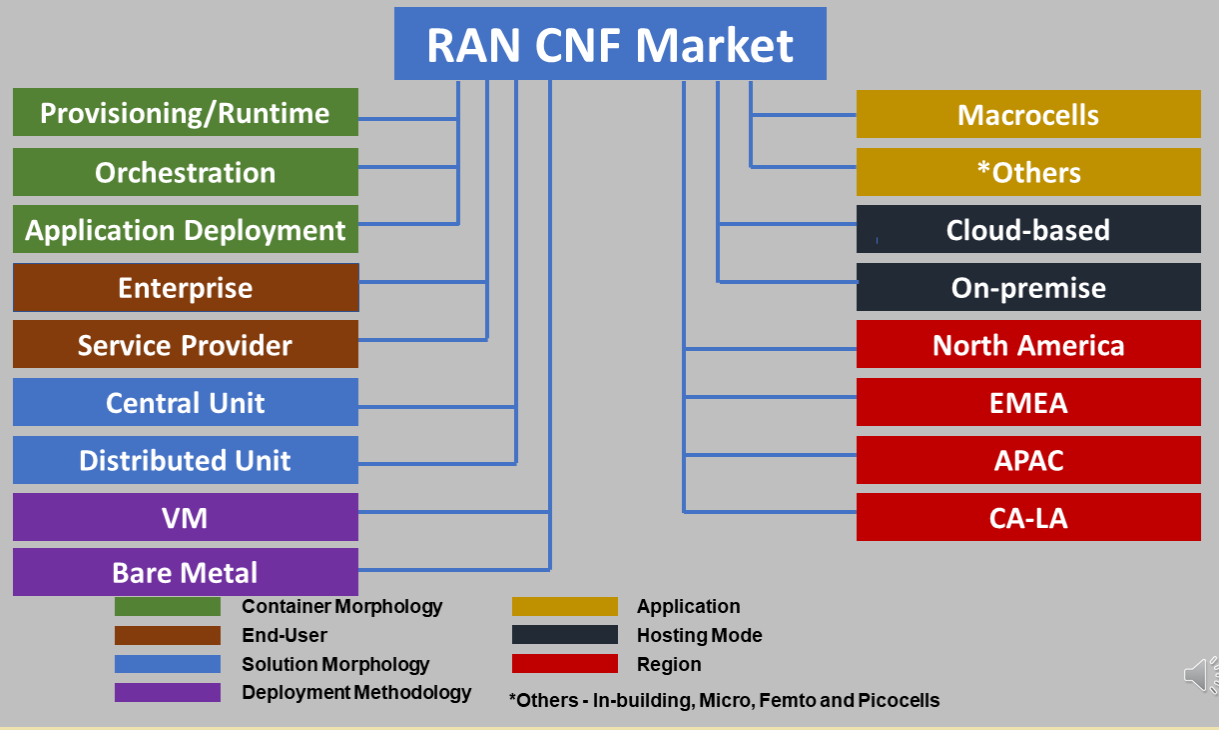


How does this affect the market?



CNFs increase the Software element in the NFs

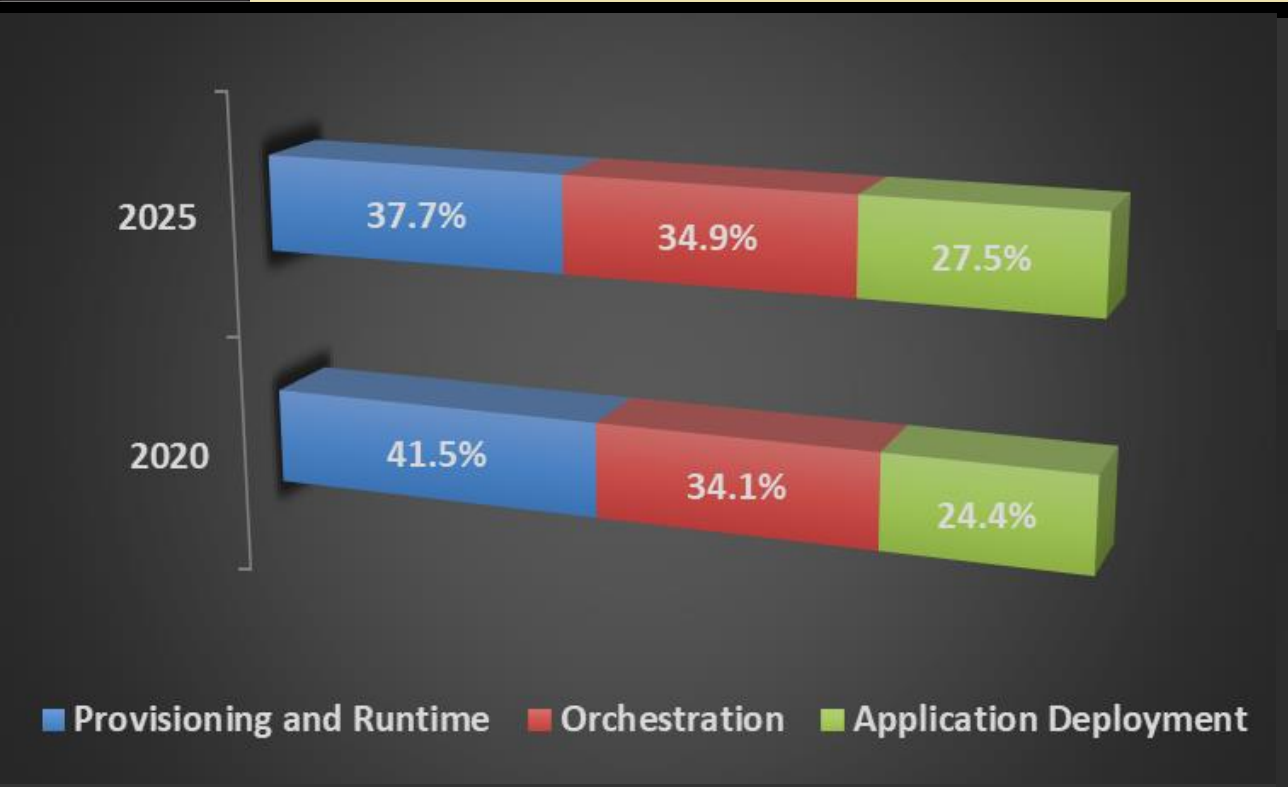




Container Morphology

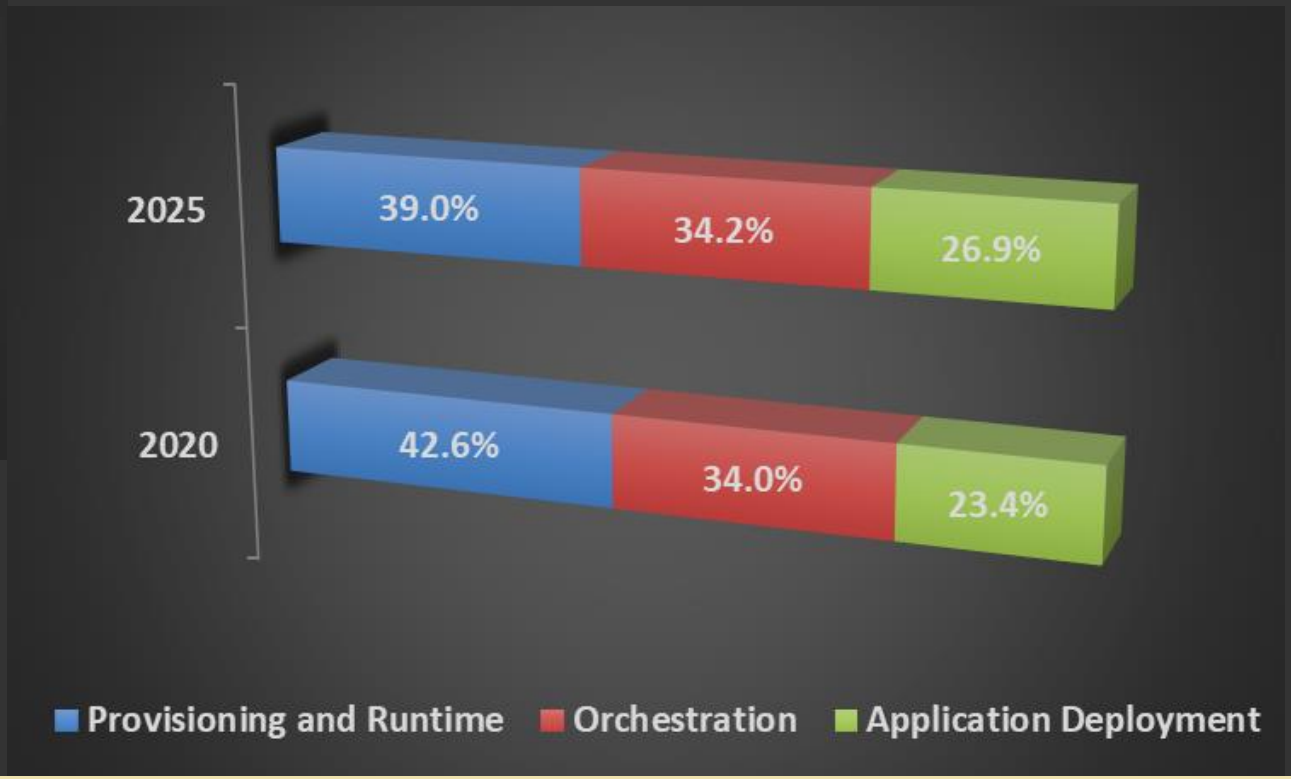
- **Provisioning and runtime functions** relate to creating the spadework for containers. Provisioning functions included in this block relate to the management of underlying cloud and server resources and application development tools. Runtime function is critical for the integrity of individual containers.
- **Orchestration** was necessitated by the relative immaturity of containers to perform in groups for a given context or a given function. Orchestration function covers scheduling, service delivery, remote procedural calls (RPC), service proxy, service mesh and API gateway. K8s
- **The application development and definition block** is where the CNF translates into application logic for specific network functions. This block covers architectural aspects related to database, streaming, messaging, image building, CI/CD.

Software in NF BoM is on the rise



Core Network Function

RAN Network Function



Software lowers entry-level barriers for telcos to meddle with NF engineering..

"We can give the design, layouts and board support packages to third-party manufacturers to have our gear made"

Unnamed Jio Executive, The Economic Times

Jio – Interesting Chronology

- Jio joined ONAP began in April 2017 as Platinum member, contributing resources for the programs and initiatives of the Linux Foundation as well as setting up centers of excellence
- In January 2018, Jio announced vRAN investment plans with Cisco, Altiostar, Aricent, Intel, Mavenir, Phazr, Red Hat and Tech Mahindra as vendor partners.
- In February 2018, Jio joined the Open vRAN initiative, promoted by Cisco.
- 4G software firm Rancore Technologies, a Jio subsidiary acquired US-based software company Radisys in 2018.
- In December 2018, Jio joined the O-RAN Alliance board.
- In March 2020, Jio announced that it had developed 5G network infrastructure technology in-house and sought the Indian government's permission to test it and conduct trials.
- Jio's present **investors** include Intel, Qualcomm, Facebook and Google among others

Airtel seems to have charted the more traditional path

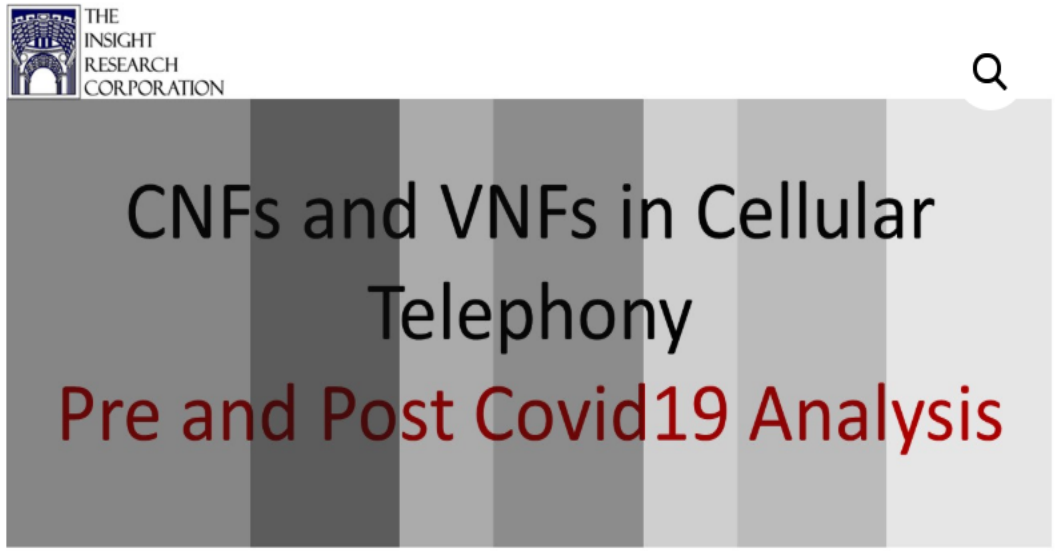
- November 2015 - Initiated "Project Leap" to swap all legacy networks and base stations and is working on SDN and NFV as alternatives.
- October 2017 - Airtel and SK Telecom to benefit from the latter's expertise in technologies including 5G, NFV and SDN.
- April 2019 - Selected Ericsson's cloud VoLTE solution
- November 2019 - Selected Ericsson for deploying 5G-ready Cloud Packet Core
- January 2020 - Partnered with Huawei, ZTE, Ericsson and Nokia for 5G trials
- February 2020 - Selected Ceragon's all-outdoor multicore solution and related services
- April 2020 - Deployed the Open vRAN solution offered by Altiostar.
- April 2020 - Signed $1 billion deal with Nokia for 300,000 5G-ready base stations
- May 2020 - Airtel and Sercomm launched vRAN-based (virtualized radio access network) TDD small cell
- July 2020 - Deployed India's largest open cloud-based VoLTE network with Nokia

The opportunity is not for Jio alone, software encourages smaller entrants

- Cisco Systems
- Ericsson
- Huawei
- NEC/Netcracker
- Nokia
- Samsung
- ZTE

V/S

- ASOCS
- Affirmed Networks
- Altiostar
- Athonet
- Baicells
- Cirrus Core Networks
- Mavenir
- Phluido
- Quortus
- Parallel Wireless



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Principal Analyst – Insight Research
kaustubha@insight-corp.com