TÉRAL RESEARCH
WIRELESS INDUSTRY ANALYSIS

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5G SA CORE, SDM, POLICY & CHARGING

Finally, the migration to standalone mode picks up some steam.

In This Report

Based on a service provider survey and discussions with many vendors, this report analyzes several of the 5G Core SBA functions and provides global and regional market sizes and forecasts by focusing on the most imminent network functions to be implemented by CSPs (UDM, UDR, AUSF, and PCF, BSF, CHF).

Abstract

5G rollouts began in non-standalone (NSA) mode and are now shifting to SA to unlock broader use cases. SA's service-based architecture (5G SBA), designed by 3GPP, introduces new functions like network slicing while building on existing 2G/3G/4G network elements. Ultimately, it aims to become the unifying backbone across all networks, including fixed and non-terrestrial.

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Abstract

5G rollouts started with the non-standalone (NSA) mode and are now gradually migrating to SA to unleash a plethora of use cases. 5G SA goes far beyond mobile and will eventually become the network that bridges all networks together, with the new sophisticated service-based architecture (5G SBA) designed by the 3GPP. Although many of the network functions (NFs) featured in the 5G SBA come from existing ones currently active in 2G/3G and 4G networks, novel functions such as the network slice selection function (NSSF) are being introduced. Based on a communications service provider (CSP) survey and discussions with many vendors, this report analyzes several of the 5G Core SBA functions and provides global and regional market sizes and forecasts by focusing on the NFs implemented by CSPs (e.g., UDM, UDR, AUSF, NRF, NEF and NSSF, PCF, BSF, CHF) to enable use cases beyond enhanced mobile broadband (eMBB), fixed wireless access (FWA), and private 5G.

Key Takeaways: Finally, the migration to 5G SA is materializing

After a slow start during the past 5 years, the migration to 5G SA has picked up some steam: of the total 354 5G commercial public networks reported at the end of 1Q25, 74 are 5G SA, from 49 a year ago. In fact, 2024 saw the highest number of 5G SA commercial launches: 21 networks went live to offer commercial services last year. The success of FWA services, the introduction of smartphone plans enabled by the increasing number of available 5G SA devices, and the rise of VoNR drove this SA migration. Key findings include:

- Network slicing is taking off for various services, including for military use cases.
- The single vendor approach remains predominant for each domain.
- 67% of 5G SA core deployment are cloud-based but due to data sovereignty concerns, CSPs favor private cloud infrastructures.
- The global 2024 market for 5G SA Core + SDM + Policy & Charging grew 12% YoY and hit $3.8B, slightly below our forecast.
- Sustained by its domestic market, Huawei leads global 2024 sales for 5G SA Core + SDM + Policy & Charging, followed by Ericsson and Nokia, respectively. However, Nokia leads the global commercial 5G SA footprint. ZTE comes in fourth place for global total sales and second for 5G SA core sales behind Huawei.

In the meantime, technical challenges related to 5G network architecture complexity, 3GPP methods for exchanging information across 4G vs. 5G, policy orchestration and enforcement, real-time analytics and insights and data analytics are still lingering but being solved.

Built on a solid CSP pipeline of 559 cellular networks in the world that have yet to be migrated to 5G SA, our model produced a forecast that shows the global 5G SA Core/5G Data Management/5G Policy market to cross the $4B bar by year-end, which is 20% YoY growth. Last year's downward revision put our forecast on track and therefore we have not made any significant change in this forecast update.

In the long run, we foresee a significant ramp up in CSPs' migration to 5G SA that adds to the ongoing activity continuously fueled by the emergence of new use cases going beyond eMBB, FWA, and private 5G, we expect the market to grow at a 2025-2030 CAGR of 11%. Asia Pacific will remain the largest market throughout the forecast period and 5G SA core the most important domain to start with, followed by 5G Data Management.

And finally, the disaggregated multi-domain nature of 5G core SBA brings a broad range of contenders that include the traditional telecom network equipment vendors, a few mobile core specialists, a handful of subscriber data management (SDM) specialists, a truck load of policy and charging rules function (PCRF) players, the OSS/BSS providers and the system integrators and providers of IT services.

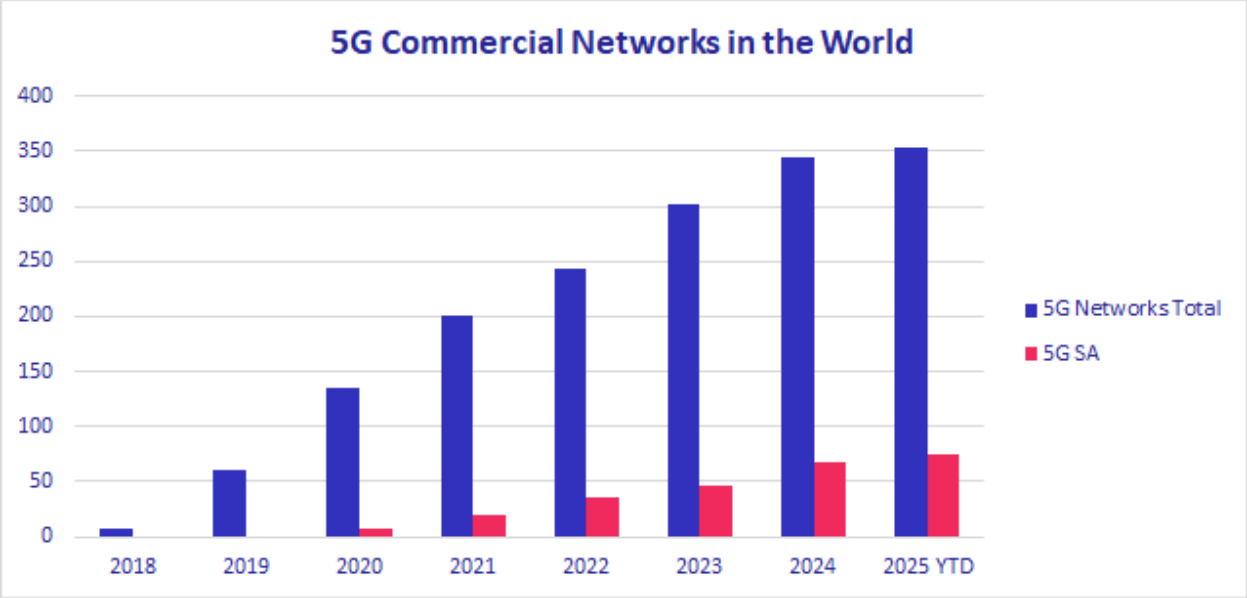
Driven by FWA, smartphone plans and voice over NR, the migration to 5G SA is taking off

After a few years of false starts and lumpy migration to 5G SA, the adoption is showing some signs of acceleration: as of June 26, 2025, the world hosts 74 commercial 5G SA networks vs. 49 at the same period last year, which is a 51% YoY jump.

2024 SAW THE HIGHEST NUMBER OF 5G SA COMMERCIAL LAUNCHES SO FAR

21 SA networks went live and offered commercial services last year, a record to date! In addition, a total of 22 5G networks including NSA and SA were added. Figure 1 shows the number of commercially available 5G SA networks at the end of December 2024 and year to date in 2025, per the Global mobile Supplier Association (GSA): 67 and 74, respectively. In the meantime, GSA has identified 124 CSPs in 58 countries that have been investing in 5G SA networks. Consequently, the number of launched 5G SA commercial networks is expected to rise significantly by the end of the year.

Figure 1: 5G and 5G SA Commercial Networks in the World



Source: GSA, TÉRAL RESEARCH

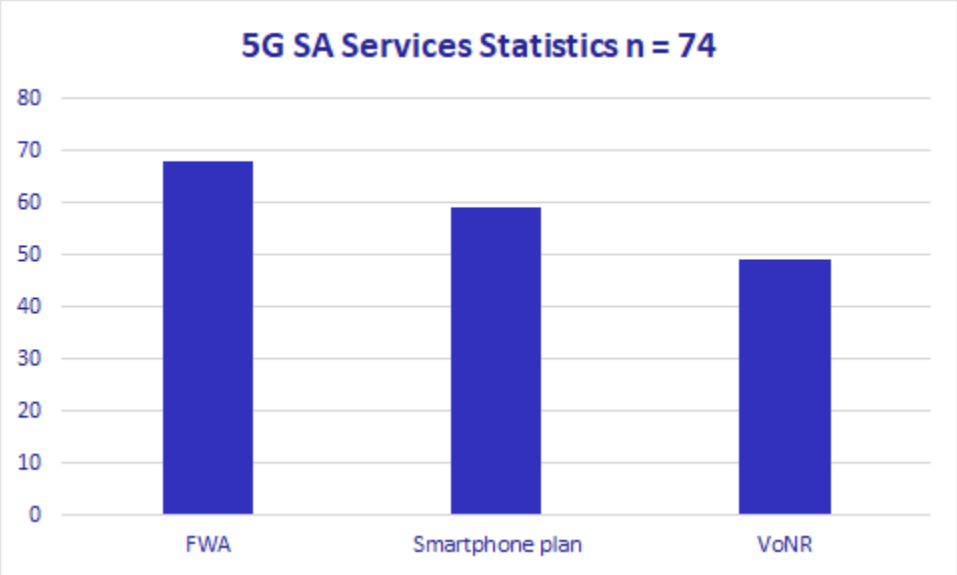
68 OF THOSE 5G SA NETWORKS WERE LAUNCHED FOR FWA SERVICES

In our database that tracks CSPs' 5G SA commercial networks, we found that 92% of them (Figure 2) migrated to 5G SA to specifically support fixed wireless (FWA) services for both residential and enterprise markets; roughly one third of the CSPs launched their FWA services

specifically for enterprise markets, mostly CSPs with 5G SA in mid spectrum bands (i.e., 3.5GHz).

Among the 74 CSPs operating commercial 5G SA network, 59 and 49 offer a smartphone plan and a voice over new radio (VoNR) service, respectively. It's worth noting that these 2 services are offered by CSPs operating a combination of low (e.g., 600MHz to 1GHz), mid (e.g., 1.8GHz, 2.5GHz, 3.5GHz) and high bands (e.g., 24-26GHz). Lastly, a dozen CSPs deployed 5G SA specifically for private 5G networks, in fact a handful of them are just doing that for now.

Figure 2: 5G SA Commercial Services



Source: TÉRAL RESEARCH

THE RISING AVAILABILITY OF MORE 5G SA-CAPABLE DEVICES IS FUELING 5G SA

According to GSMA, the share of 5G SA devices among all announced 5G devices has been steadily climbing, as of March 31, 2025, the number of 5G SA-capable devices rose to 2,334, which is up 34% YoY. Overall, CSPs are happy to see that 5G technologies are evolving into 5G Advanced, a second wave of technology innovations that can deliver on the full promise of 5G.

NETWORK SLICING, THE TRUE POWER OF 5G SA, IS COMING TO LIFE

At this point, several CSPs including NTT docomo, KDDI and Softbank in Japan, SingTel, M1 and StarHub in Singapore, Deutsche Telekom and Vodafone in Germany, Orange across Europe, Telia and Telenor in Scandinavia, and Verizon are actively offering commercial 5G network slicing services to enterprises and industries, enabling them to tailor network resources

for specific needs, and have joined the early adopters: China Mobile, China Telecom, China Unicom, and T-Mobile US. More CSPs are coming on board across the globe.

5G SA NETWORK SLICING FOR MILITARY IS EMERGING AS THE MOST UNLIKELY USE CASE

Who would have predicted this one? Well, the process started with the creation of the U.S. Department of Defense (DoD) FutureG initiative, also known as the 5G and Future Generation Wireless Cross-Functional Team on March 9, 2022. This team was created to accelerate the adoption of 5G and future wireless technologies to ensure the DoD can operate effectively in various environments, including congested networks. The legislation that mandated its creation was the 2021 National Defense Authorization Act.

In April 2025, Nokia, Telia and the Finnish Defense Forces announced that they successfully conducted the world's first seamless 5G SA slice handover between multiple countries in a live network. This groundbreaking trial, carried out in Finland in March, represents a significant milestone in advancing critical 5G capabilities for defense and other mission critical industries.

The trial was achieved through Nokia's 5G Core Software as a Service (SaaS) and AirScale 5G base stations powered by ReefShark System-on-Chip technology, connected to Telia's commercial network. Additionally, Nokia's intelligent network management system, MantaRay NM, provided a consolidated network view, optimizing monitoring and management.

CONSEQUENTLY, THE GLOBAL 5G SA CORE, 5G DATA MANAGEMENT AND 5G POLICY & CHARGING MARKET GREW 12% IN 2024

The global 5G Core market that includes 5G SA, 5G data management and 5G policy & charging market hit $3.8B in 2024, which is slightly below our forecast of $4B. Once again China, followed by North America, drove the bulk of the growth.

- **5G SA core**: (59% of total) hit $2,268M vs. our $2,478M forecast, 3% YoY growth vs. 7% the previous year.
- **5G Data Management**: (21% of total) topped $801M vs. our $808M forecast, 18% YoY growth vs. 11% the previous year
- **5G Policy & Charging**: (20% of total) reached $753M vs. our $771M forecast, 38% YoY growth, vs. 27% the previous year.

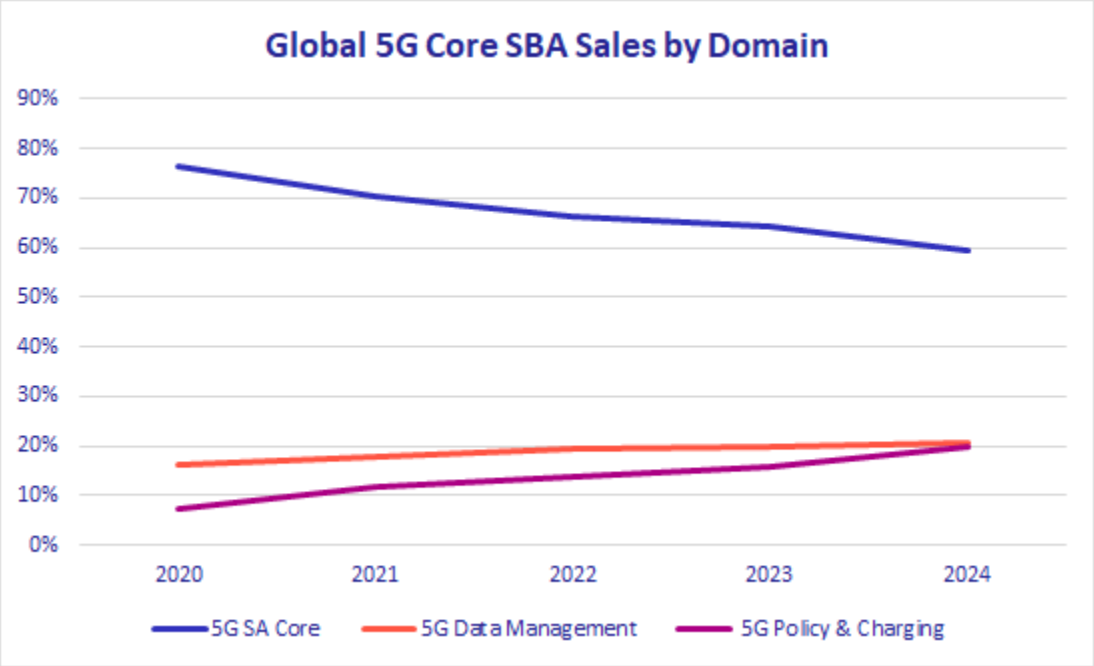
As described in the *Methodology* section of the accompanying Excel file, our model is based on current typical software business models for vEPC, vPCRF, and SDM, and their typical $/subscriber and/or $/connection and $/Gbps, broken down in the 3 major categories above. It's important to note the following aspects of our methodology (see Excel spreadsheet):

- **5G SA Core** numbers come from our latest quarterly Wireless Infrastructure report and no longer contain data management and policy & charging numbers. 5G SA Core

numbers only include the session and user plane functions derived from 4G EPC (e.g., UPF, SMF, AMF) + 5G core resource and registry functions (e.g., NSSF and NRF) + NEF + AF + SCP.

- **5G Data Management** numbers are derived from subscriber data management (SDM) numbers that we collect and/or estimate annually. These include UDM, UDR, FE, and AUSF derived from SDM numbers composed of HLR/ngHLR and HSS.
- **5G Policy and Charging** numbers are derived from vPCRF numbers that we collect annually. These include PCF, BSF and CHF derived from vPCRF market size and forecast.

Figure 3: 2024 Global 5G Core SBA Sales by Domain



Source: TÉRAL RESEARCH

THE SINGLE VENDOR APPROACH REMAINS PREDOMINANT FOR EACH DOMAIN

Selecting NFs from various vendors to build a full 5G SA network remains nonexistent. Our research indicates that at least 75% of the current 5G SA commercial networks use just one vendor for each 5G core domain as defined in this report. In other words, the predominant configuration consists of:

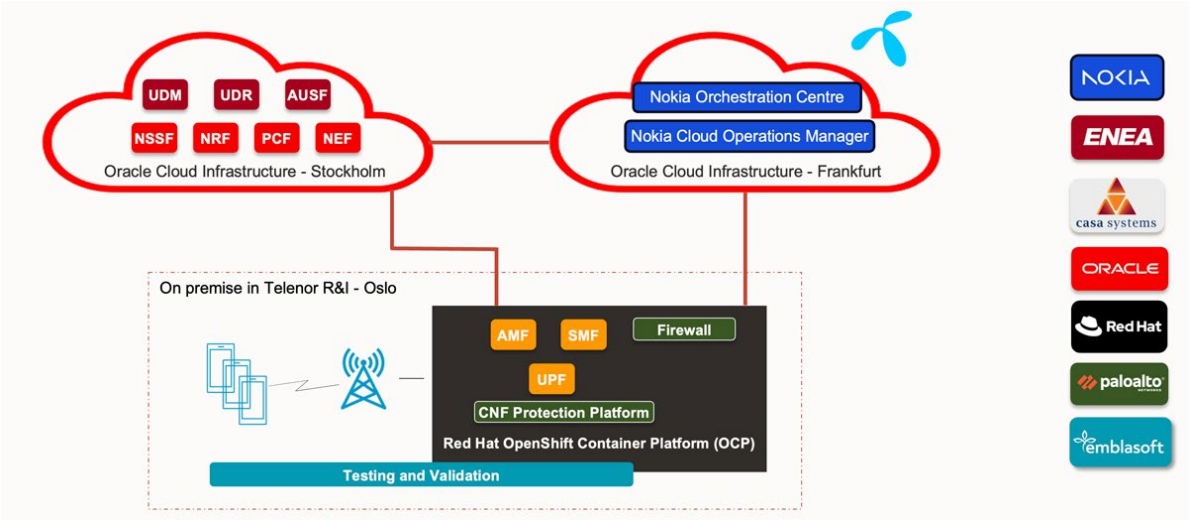
- 5G SA Core = Vendor 1
- 5G Data Management = Vendor 2
- 5G Policy & Charging = Vendor 3

Being able to pick and choose the best of NF breed in the marketplace is the greatness of the 3GPP 5G core service-based architecture (SBA) but it also creates a fundamental integration issue of multi-vendor core NFs; who is in charge? During the pandemic lockdowns, CSPs busy at sorting out how to assemble the full 5G SBA found that the software components do not always work straight out of the box. Some cloud-native network functions (CNFs) may have issues registering with the NRF, which as mentioned at the beginning of the report is an important component of the 5G SBA architecture. As a result, these CNFs must be manually registered with the NRF.

TELENOR IS THE ONLY CSP IN THE WORLD TO HAVE ADOPTED A MULTI-VENDOR 5G SA CORE PLATFORM BUT HAS YET TO LAUNCH IT COMMERCIALLY

Last year at MWC24 in Barcelona, Spain, Telenor Research and Innovation (R&I) said it had successfully conducted its first multi-vendor 5G SA deployment within a hybrid cloud environment, covering both public and private cloud infrastructure.

Figure 4: Telenor's multi-vendor 5G SA core approach



Source: Telenor

Figure 4 illustrates Telenor's multi-vendor 5G SA core approach:

- Oracle Cloud Infrastructure (OCI) provided the public cloud, while Telenor R&I's data center in Oslo hosted the private cloud component. Within OCI, Telenor provisioned and operated control plane components from Oracle and Enea, specifically Oracle's Policy and Routing functions (NSSF, NRF, PCF, and NEF) and Enea's Subscriber Data Management (UDR, AUSF, UDM).
- Casa Systems' (now part of the Lumine Group as a result of last year's restructuring under Chapter 11) packet core (AMF, SMF, UPF) as well as cloud-native application protection platform (Prisma Cloud Compute) plus ML-Powered NGFW Strata - both from

Palo Alto Networks, run on-premises with Red Hat OpenShift and were fully integrated with the control plane on OCI.

- Also onboarded to operate on OCI were Nokia's Orchestration Center, Nokia's Cloud Operation Manager and Emblasoft's Evolver. Nokia's Cloud Operations Manager and Nokia's Orchestration Center managed the complete lifecycle of the multi-vendor 5G core while the Evolver, which is a 5G Radio and UE simulator, provided a comprehensive end-to-end validation of the 5G Core.

The cloud infrastructure deployment was enabled by Terraform and Red Hat Ansible Automation Platform, tools already used on-premises by Telenor R&I. For this effort, Telenor also seamlessly transitioned to OCI's Oracle Kubernetes Engine (OKE), a fully managed upstream Kubernetes distribution. This approach with Infrastructure as Code (IaC) tools and cloud-based managed Kubernetes demonstrated a progressive pathway for CSPs to easily transition their on-prem environments to the cloud.

It's also important to note that automation was the primary and essential objective of the effort, streamlining deployment processes and enabling single-click automated deployments.

TWO THIRDS OF TOTAL 5G SA CORE DEPLOYMENTS ARE CLOUD-BASED, THE REST ARE ON PREM APPLIANCES

Over the past 5 years, we have been reporting that deploying 5G SA on a cloud-based infrastructure was a chief challenge for the vast majority of CSPs and that alone inhibited rollouts. SA rollouts are capital-intensive, especially together with dedicated network slices. CSPs face complex decisions about where to deploy their 5G core, hybrid cloud, public cloud or on-prem cloud. And unlike legacy networks, cloud-native 5G SA NFs evolve rapidly. To gain the benefits of agility in cloud-native NFs, CSPs are gradually adopting a robust automation framework, CI/CD (continuous innovation/continuous development) pipelines for faster software rollout including test automation from day 1, K8s-based life-cycle management, cloud-based automation for efficient deployment, scaling, healing, and testing. Automated deployments reduce the time to apply frequent upgrades and to patch certain micro services in a continuous deployment workflow.

FOR DATA SOVEREIGNTY REASONS, CSPS FAVOR THE PRIVATE CLOUD APPROACH

Overall, our research indicates that because of a combination of regulation and security, a lot of CSP related IT applications reside in the public cloud but the mission-critical ones stay in their own data centers. In Europe for instance, regulators do not want critical systems and data stored in either another jurisdiction or facilities owned by a foreign country, including the U.S.

AS CONCERNS OUTNUMBER BENEFITS, THE PUBLIC CLOUD APPROACH OUTLOOK REMAINS CLOUDY

2024 was a dark year for public cloud based 5G core. Case in point: in June, Microsoft terminated its Azure for Operators efforts and divested its Affirmed Networks and Metaswitch core network software developers it acquired with great fanfare in 2020. Simply stated, Microsoft did not see any traction and after regular discussions with CSPs, we identified the main technical concerns:

- Public cloud has lower service level agreement (SLA): think of 99.999% availability, we found that SLA cloud services typically range from 99.9% to 99.99% at best. This means that the maximum annual service interruption is about 50 minutes versus 5 minutes for a carrier grade requirement. Moreover, it appears that the public cloud does not promise a short recovery time.
- Public cloud makes disaster recovery (DR) difficult: as a public cloud architecture consists of regional and edge locations, it requires sufficient presence to manage a disaster recovery effort. Typically, the control and management planes are deployed in a region while the forwarding plane resides at the edge. The distance between the locations or points of presence (PoPs) is critical to meeting the DR requirement.
- Public cloud has long switchover time: in telecoms, a service interruption caused by the overall switchover process is less than 2s versus 8 to 10s in public cloud architectures.
- Public cloud does not support ECMP: VNFs have multiplane communication requirements including layer 2 interconnection based on MAC addresses and equal-cost multipath routing ensures fast distribution (ECMP) to ensure fast distribution in a telecom cloud. In a public cloud, VNFs need to be reconstructed to use the multi-address solution and the process increases the IP address consumption.

In addition to these technical concerns, many economic ones were also cited along with the public cloud provider “lock in” aspect. Nonetheless, a few CSPs including Boost Mobile and Telefónica O2 Germany are sticking to their guns.

TELEFÓNICA O2 MIGRATED BOTH IT AND TELECOM WORKLOADS, INCLUDING THE CORE NETWORK, TO PUBLIC CLOUD INFRASTRUCTURE

The 5G core network is built entirely in the cloud, specifically the AWS cloud. The transformation began in the IT domain, where Telefónica launched a company-wide architecture overhaul to migrate every critical IT system—including billing, CRM, product catalog and order management—to the public cloud.

And of course, the charging platform was one of the most complex and sensitive components to migrate due to its handling of customer data. Telefónica addressed regulatory and sovereignty challenges by deploying confidential computing and end-to-end encryption.

Lastly and perhaps the most interesting part of this story is how Telefónica ended its long-time collaboration with Ericsson and switched to Nokia's more cloud-aligned platform.

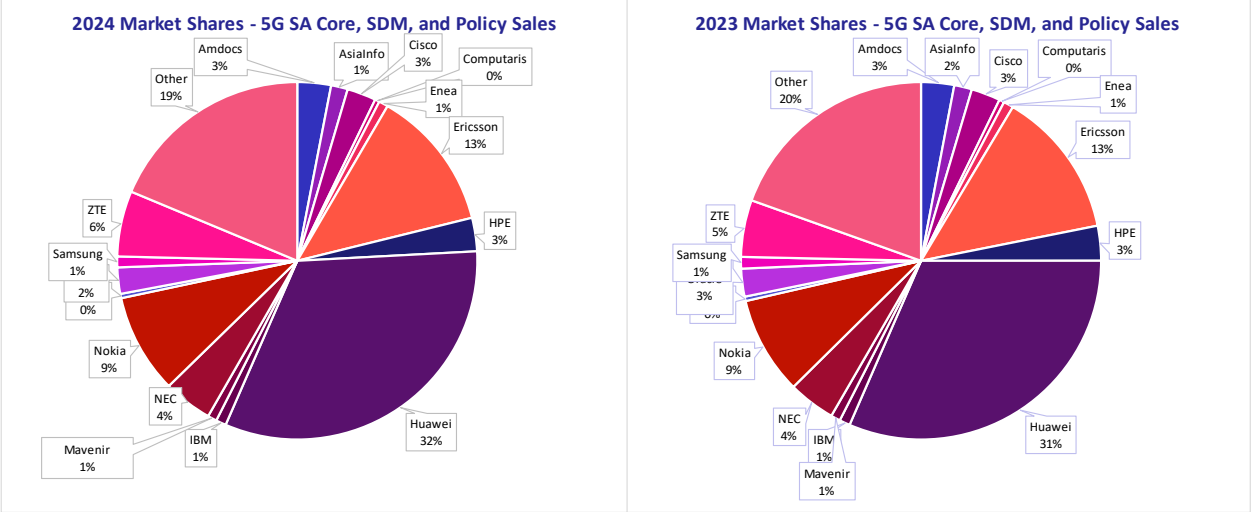
WHILE CHINA SUSTAINS HUAWEI'S SALES, ERICSSON AND NOKIA COMMAND THE LION'S SHARE OF THE GLOBAL 5G SA FOOTPRINT

Once again, China sustains Huawei's 5G SA business. China is a huge market and when there is a shift to 5G SA during a time of heightened geopolitical tensions, the 2 Chinese vendors rely on their domestic market to win the lion's share of the orders from just the 3 Chinese CSPs. In 2024, Huawei and ZTE combined commanded:

- 38% of the global 5G SA Core/5G Data Management/5G Policy & Charging market vs. 37% in 2023. Huawei alone commands 32% of the total, driven by 5G SA Core (51% share) and Subscriber Data Management (37%) sales. The lower share results from the fragmentation of the data management and policy and charging markets that are crowded by a plethora of vendor specialists—as discussed later in this report.
- 67% of global 5G SA core sales, slightly up from 66% last year.
- 42% of global Subscriber Data Management sales.

Overall, Huawei leads all categories covered in this report.

Figure 5: 2024 vs. 2023 5G SA Core, SDM, and Policy Vendor Market Shares



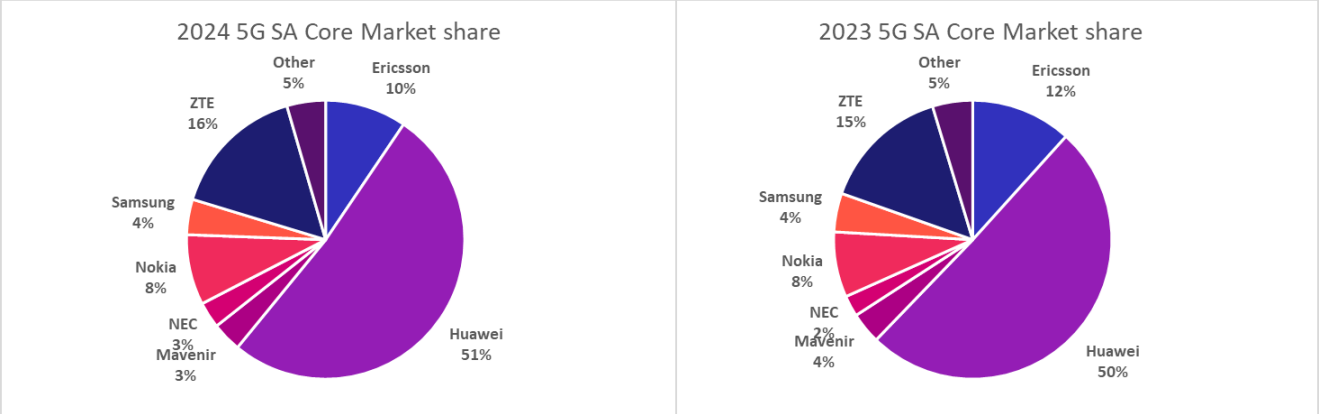
Source: TÉRAL RESEARCH

WHILE ERICSSON AND NOKIA TRAIL HUAWEI'S SALES, THEY STAY #2 AND #3, RESPECTIVELY AND COMBINED, COMMAND 63% OF THE GLOBAL 5G SA FOOTRPINT

While Ericsson continues to stay ahead of Nokia from a revenue standpoint—just by 1 percentage point after Ericsson lost 2% percentage points in 2024. Nokia kept its share steady

at 8% (see Figure 6). The situation is different when it comes to analyzing in detail the 5G SA footprint worldwide. Regarding SDM and Policy and Charging markets shares, both vendors' shares have been stable over the years.

Figure 6: 2024 vs. 2023 5G SA Core Vendor Market Shares



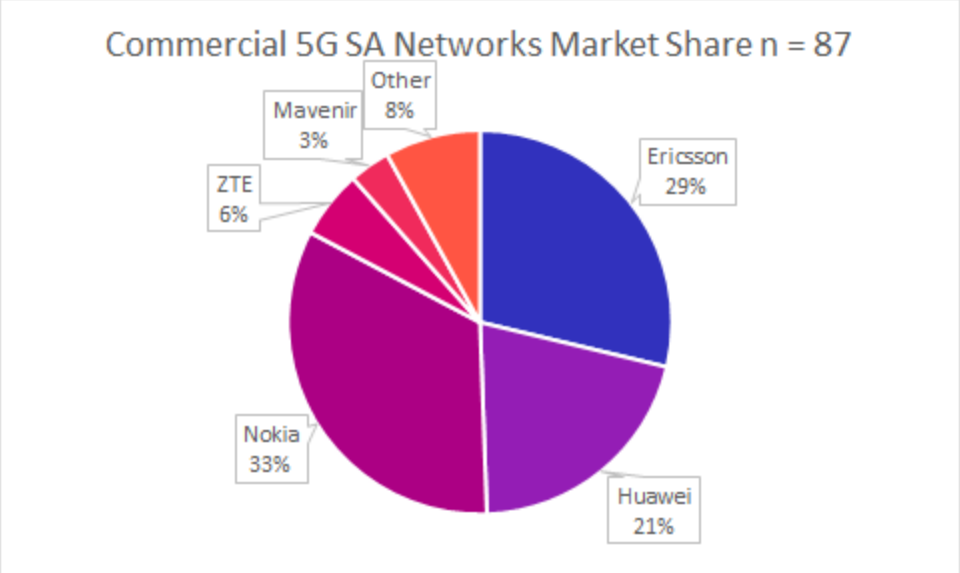
Source: TÉRAL RESEARCH

NOKIA COMMANDS 33% OF THE GLOBAL COMMERCIAL 5G SA FOOTPRINT

This is the 6th edition of this report and since the first commercial 5G SA networks launched in 2020, we have been tracking the 5G SA contracts awarded to the vendors by the CSPs. It's important to mention that:

- This is the first time we have released this vendor ranking (Figure 7) and as our database includes confidential information protected under NDA with both CSPs and vendors, we cannot publish it.
- Due to a few CSPs that have more than 1 vendor in their 5G SA core network, the total number used to calculate the market shares is 87 and is greater than the actual number of commercial 5G SA networks (i.e., 74).
- The Other category includes Cisco, NEC, Oracle and Samsung.

Figure 7: Commercial 5G SA Footprint Vendor Market Shares



Source: TÉRAL RESEARCH

A FEW SWAPS THAT OCCURRED LAST YEAR AND NOKIA'S CLOUD STRATEGY PROPELLED THE FINNISH VENDOR TO THE TOP SPOT

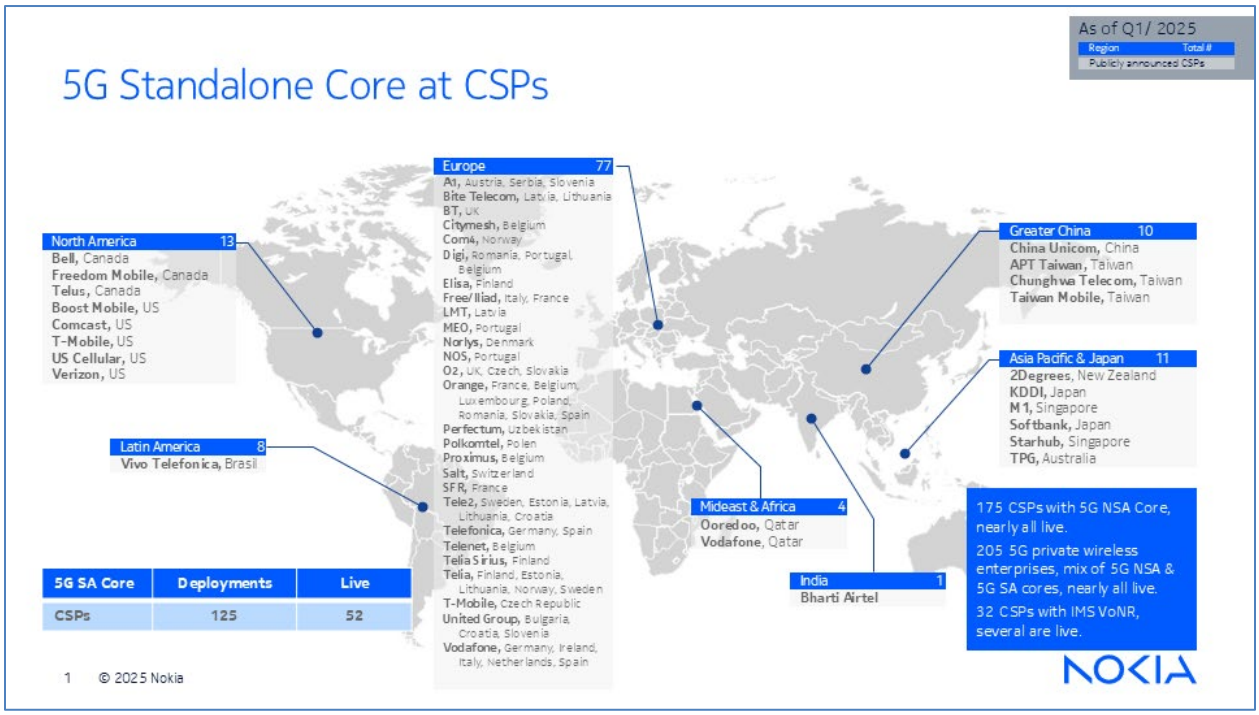
A high-profile swap example mentioned earlier and in the public domain includes Telefónica O2 Germany, which replaced Ericsson with Nokia. What we have learned from this case is that after 18 months of work building O2's 5G public cloud native network, Ericsson failed to meet expectations, particularly its reluctance to disaggregate its dual-core platform. It's worth noting that this issue is not solely related to 5G core but extends to the RAN as well. We believe 2 key developments helped Nokia to get to this leadership status:

1. Nokia's June 2021 deal with Boost Mobile (formerly DISH) to deploy 5G SA core on AWS was the trigger to achieve such success. Back in the days, there was very limited experience to deploy voice core, cloud packet core, SDM, device management and network security features in a public cloud. This was not a smooth journey from which both AWS and Nokia learned a great deal.
2. Nokia's decision in 2023 to abandon internal development of cloud infrastructure platforms and instead work via third-party partners is paying off. Although it chose IBM-owned Red Hat as its primary cloud partner, Nokia's 5G core applications were already combined with AWS cloud.

As of March 31, 2025, Nokia has:

- 125 5G SA core commercial deployments with CSPs vs. 113 last year, of which 52 are live, and 29 commercial service—we counted China Unicom as one instead of each province where Nokia is deployed.
- 175 5G NSA core commercial deployments, which remain unchanged from last year with nearly all of which are in live commercial service.
- 205 5G NSA Core or 5G SA Core commercial deployments with private wireless enterprises, nearly all are in live commercial service.
- 32 IMS VoNR commercial deployments with CSPs, several are live.

Figure 8: Nokia's 5G SA Core commercial contracts



Source: Nokia

ERICSSON IS #2 FOR 5G SA GLOBAL COMMERCIAL FOOTPRINT

As of March 31, 2025, the company claimed more than 180 5G live networks, including 120 5G cloud core customers. Of 5G cloud core contracts, Ericsson has 5G core cloud native contracts with more than 130 customers and out of those, the vendor boasts 60+ cloud native live networks and 26 commercially live 5G SA networks.

- Policy & Charging: Ericsson reported 80 PCF commercial contracts.
- Data Management: Ericsson reported 120 SDM customer contracts with 50+ live deployments worldwide.

- IMS: more than 200 customers with a majority selecting all main nodes (i.e., MTAS, CSCF and SBG); 180+ have selected virtual IMS.
- VoNR: more than 40 customers so far.

FINALLY, ZTE COMES IN FOURTH FOR TOTAL SALES AND SECOND FOR 5G SA CORE SALES MARKET SHARE

ZTE is a key 5G core supplier to the 3 Chinese service providers and has a few 5G core contracts overseas, including 17 5G SA commercial CSP networks and numerous trials in countries that have not banned the Chinese vendors. For the whole cloud core platform, ZTE claims more than 110 CSP customers worldwide, including VDF, Telenor GP, AIS, Ooredoo, Unifique, Celcom, Telkomsel, MTN, RIEDEL, Orange Côte d'Ivoire, U mobile, and Hutchinson 3. When the vendor is engaged in a swap project, it partners with Red Hat, Fortinet, Whale Cloud and Asiainfo.

MEANWHILE, NAVIGATING THE COMPLEXITIES OF EVOLVING NETWORK ARCHITECTURES, DATA MANAGEMENT, AND POLICY FRAMEWORKS REMAINS CHALLENGING

Despite the momentum that built up last year, the challenges we identified 2 years ago persist but CSPs are showing better confidence in how to handle them.

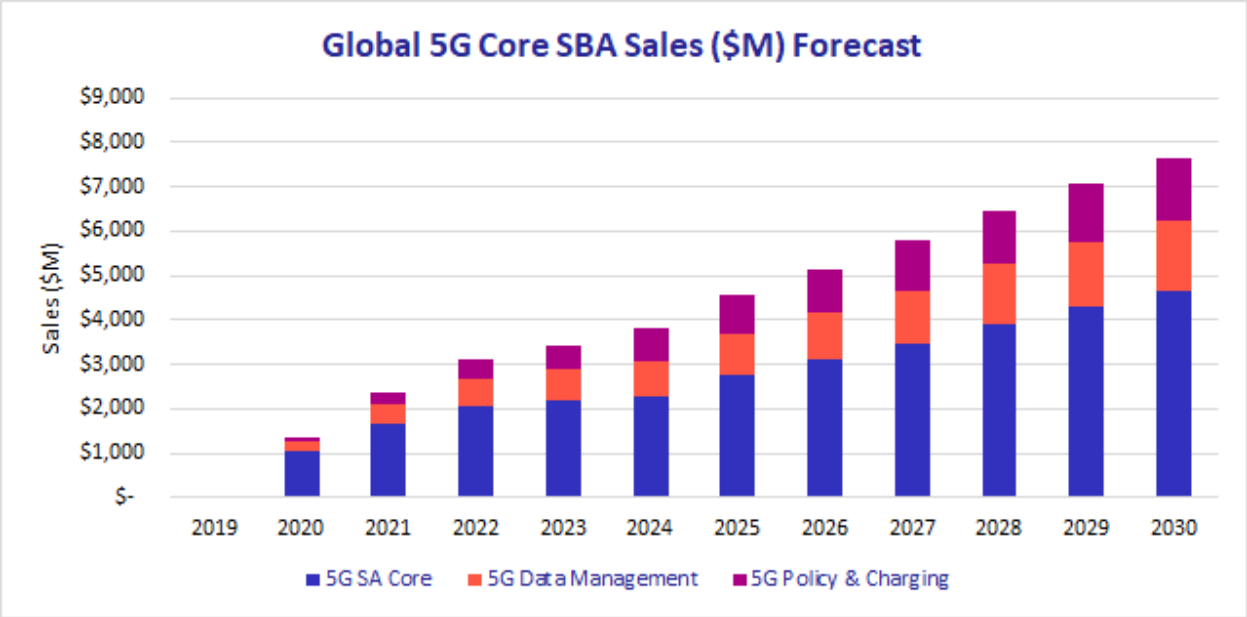
- **5G network complexity** increases across all domains with the required simultaneous deployment of AUSF, UDM, and UDR NFs at the initial phase. For example, in Ericsson's implementation, AUSF and UDM are collocated in the same node (CCSM) while UDR is a separated node (CCDM). Lastly, in a multi-vendor environment, interoperability, delivery timelines, and lack of automated deployments remain challenging.
  3GPP methods for exchanging information across 4G vs. 5G SA: as the UDM NF includes the Authentication credential Repository and Processing Function (ARPF), which generates authentication vectors for the 5G core domain, as well as for the EPC, UMTS, IMS and GBA (generic bootstrapping architecture for 3G and beyond) domains, the right interface for 4G/5G interworking and associated procedures need to be tactically chosen. 3GPP R16 UDICOM is a common approach. 3GPP has also defined interworking interfaces **N26** for EPS–5GC mobility, most PCF vendors support a converged solution, handling both 4G PCRF and 5G PCF calls on the same converged policy platform.
- **Policy orchestration and enforcement**: PCF is more powerful than PCRF but policy orchestration tools are not standardized, and each vendor has a different mechanism. Slice orchestration for example, assigning different PCF instances per slice vs. PCF common for a single slice is at an early stage of implementation.

- **Real-time analytics and insights**: the ability to derive actionable insights from subscriber data in real time, and to apply dynamic policies based on these insights is challenging due to the scale and speed of data generated in 5G networks.
- **Data analytics**: is a very complex process that requires a lot of processing capacity and that could jeopardize traffic if provided by same network entities. As a result, the SDM system needs to allow data extraction at any point in time, which can be used to produce data analytics without impacting core networks' traffic roaming handling for VoLTE, VoNR, VoWIFi, IoT, and network slicing.

All this means that the 5G SA market is poised for a solid double-digits growth through 2030

Since last year's forecast downward revision that also factored in the number of 5G contracts won by Ericsson and Nokia, we have not made any significant changes. We expect the total 5G Core SBA market to hit $4.6B by the end of the year, a solid 20% YoY growth, and to continue to grow at a 2025-2030 CAGR of 11% to reach $7.7B by 2030. We foresee the continuity of the significant ramp up in CSPs' migration to 5G SA that started in 2H24, coming from the pent-up demand created by the delays seen from 2020 to 2023 (see Figure 1 at the beginning of the report). We have not made any significant changes to our forecast that has been trending accordingly.

Figure 9: Global 5G Core SBA (SA Core + Data Management + Policy & Charging) Sales Forecast



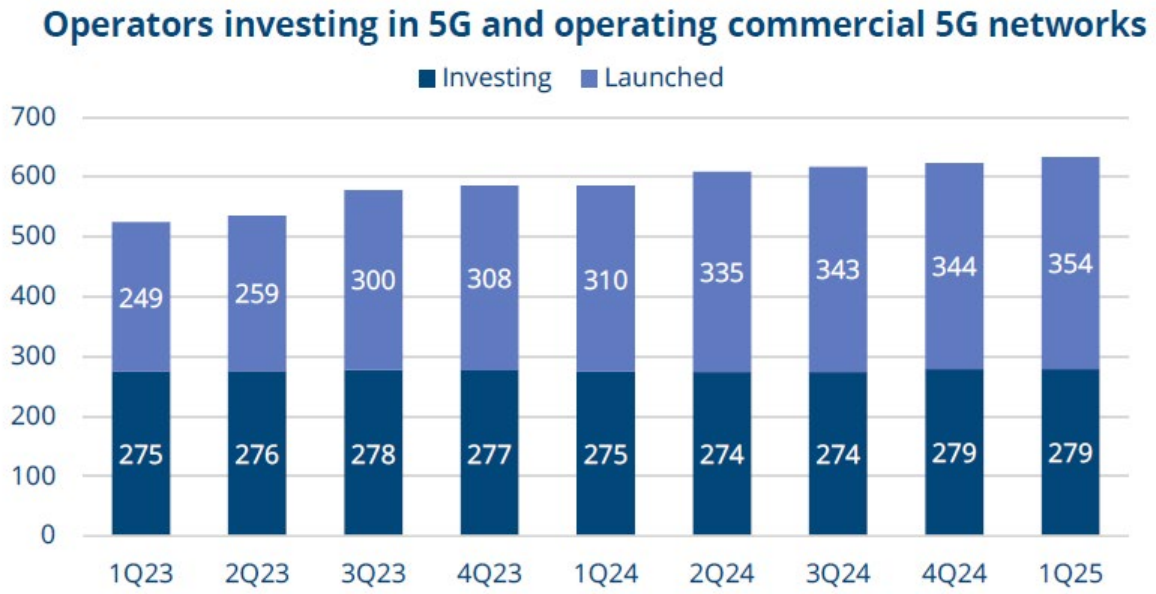
Source: TÉRAL RESEARCH

The selection of the right 5G SA core platform is the top priority and to make the right decision, CSPs need to be clear about the type of applications they plan to run, the security framework they want to implement, the upgradability roadmap, and how the whole system will come together in a unified cloud. With 5G RAN up and running with adequate combination of coverage and capacity, CSPs are taking the time to think about how to design a new cloud architecture that needs to coexist with the current vEPC, which is serving the customers while identifying lucrative 5G use cases.

OUR FORECAST MODEL FACTORS IN THE 559 CELLULAR NETWORKS IN THE WORLD THAT HAVE YET TO BE MIGRATED TO 5G SA

The calculus is simple: 354 (NSA+SA total) – 74 (SA) + 279 CSPs investing in 5G (Figure 10) = 559. What's remarkable is the almost even split: the world has 354 5G networks commercially launched while 279 CSPs are actively investing in 5G but have yet to deploy it in their LTE networks. Given that there are about 833 commercial LTE networks in the world, there are still slightly less than 200 of those networks that are left untouched.

Figure 10: Number of operators investing in 5G and operating commercial 5G networks



Source: Global mobile Suppliers Association (GSA)

5G SA CORE WILL CONTINUE TO MAKE THE BULK OF SALES THROUGH 2030

As said at the beginning of this report, the 5G SA core domain is the most important component to start with, followed by data management, and therefore will continue to dominate the activity when a CSP starts the process of moving from 5G NSA to 5G SA. As the promised 5G use cases emerge, the need for BSF and CHF NFs will rise, but this will take some time and consequently, we expect the breakdown to remain stable throughout the forecast period:

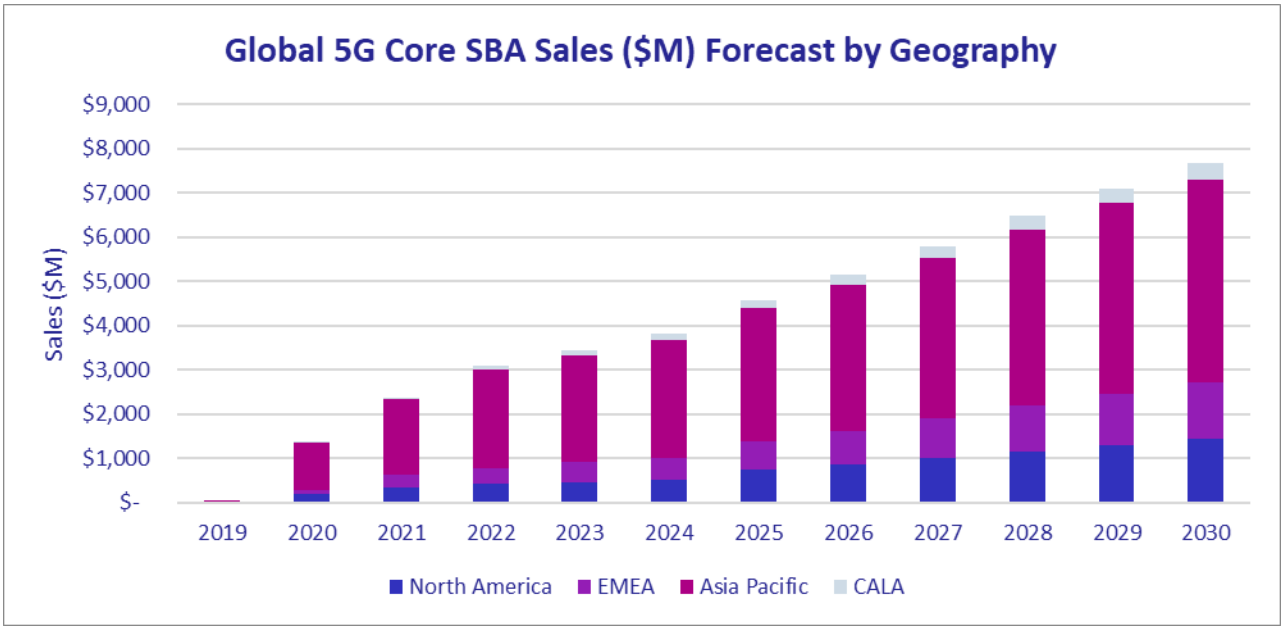
- **5G SA core**: from 60% of global sales in 2025 to 61% in 2030.
- **Data management**: from 21% of global sales in 2025 to 21% in 2030
- **Policy and charging**: from 19% of global sales in 2025 to 18% in 2030

These statistics come from our model fed by the research data gathered since the fall of 2020 until June 2025 and reflect the current 5G SA core market developments, which depending on the market dynamics, might change.

ASIA PACIFIC WILL BE THE LARGEST MARKET THROUGHOUT THE FORECAST PERIOD

With 1.8B mobile subscribers in China and another 1.17B in India, there is no surprise—and look at Huawei's market share—to find that our model (see *Methodology* in the Excel file) produced a 5G core SBA market for Asia Pacific accounting for 66% of the total in 2025. As Japan and South Korea add to China and India comes on board in the mid to long term, Asia Pacific's share will stay above 60% of the total and will shrink to 60% by 2030 as other regions come on board; North America will increase its share from 16% in 2025 to 20% in 2030.

Figure 11: Global 5G Core SBA (SA Core + DM + Policy & Charging) Sales Forecast by Geography



Source: TÉRAL RESEARCH

FWA WILL REMAIN THE CHIEF USE CASE DRIVER…

Our discussions with CSPs and vendors point to FWA as the chief driver du jour; all reported a strong demand for FWA across the board and are putting a big bet on it. Case in point: in 2024, FWA continued to serve as a growth engine for Verizon's broadband business as its FWA client base topped 4.6M subscribers, including both consumers and enterprises. As a result, Verizon has doubled its FWA subscriber target, aiming for 8 to 9M by 2028. Moreover, in 1Q25, AT&T, Verizon, T-Mobile, Comcast, Charter Communications and Altice marked the 11th consecutive quarter in which FWA has accounted for nearly all broadband net additions in the US,

highlighting its growing role in the nation's connectivity landscape. During this quarter, AT&T, Verizon, and T-Mobile collectively added 913,000 new connections, bringing the total number of 5G FWA connections in the U.S. to 12.5M. This would never have been possible without the deployment of the 5G C-band spectrum.

According to Ericsson, of the 350M FWA connections forecasted globally by 2030, 80% are expected to be on 5G. However, there is no need for a 5G SA core to support FWA on Day 1, it is when the number of subscribers goes up that the need emerges. That's exactly what Verizon, among other CSPs, has been doing: doing the development and the testing to be ready for prime time. Put another way, as more smartphones and IoT devices that support 5G SA get adopted in the marketplace, Verizon wants to time its SA-capable core and radio access network, so that devices, core and RAN can evolve together. Once 5G SA is up and running, network slicing can be implemented.

FWA IN PRIVATE 5G NETWORKS IS ALSO GAINING MOMENTUM

Like last year, private wireless networks are saving the day and giving hope to many CSPs and vendors involved in and entering the space, but the deals are disparate and mostly small and large volumes are desired to make a solid business case. Our discussion with the ecosystem suggests that both commercial 4G/5G private network deployments and 5G FWA for enterprise testing, including security network slices, have increased significantly YoY.

In private networks, 5G SA offers scalability, low and predictable latency, improved positioning, and fast data transfer, which can significantly increase productivity in logistics or manufacturing operations by enhancing precision and enabling real-time communication between devices and systems.

Although 4G LTE still accounts for 75% of the ongoing private mobile network deals, we expect the share of 5G to grow gradually.

…WHILE THE RISE OF OPEN APIS AND AN EXPANDING 5G SA DEVICE ECOSYSTEM ARE CHIEF ENABLERS

We reported this positive change last year and since, the momentum has been building up. Our discussions with vendors and CSPs point to 2 favorable forces that have the potential to fuel the adoption of 5G SA:

- **Open APIs**: are recognized as having a significant impact on 5G SA implementations because they enable CSPs to expose their network capabilities and resources as a service to developers, enterprises, and other stakeholders. This exposure through open APIs allows third parties to access and leverage the unique features of the 5G SA network, such as high-speed data, low latency and network slicing. Open network APIs are essential for advanced use cases such as cloud gaming, connected vehicles,

managing XR-type applications, and remote patient care, driving new revenue opportunities for the wireless ecosystem. All these services are enabled by the inherent 5G SA technology capabilities.

- **5G SA device ecosystem**: which includes phones, fixed wireless access (FWA) equipment and CPEs, and IoT modules, is developing. As more devices become commercially available with 5G SA support, more CSPs will be encouraged to adopt 5G SA. In addition, the availability of Reduced Capability (RedCap) devices will further facilitate widespread adoption.

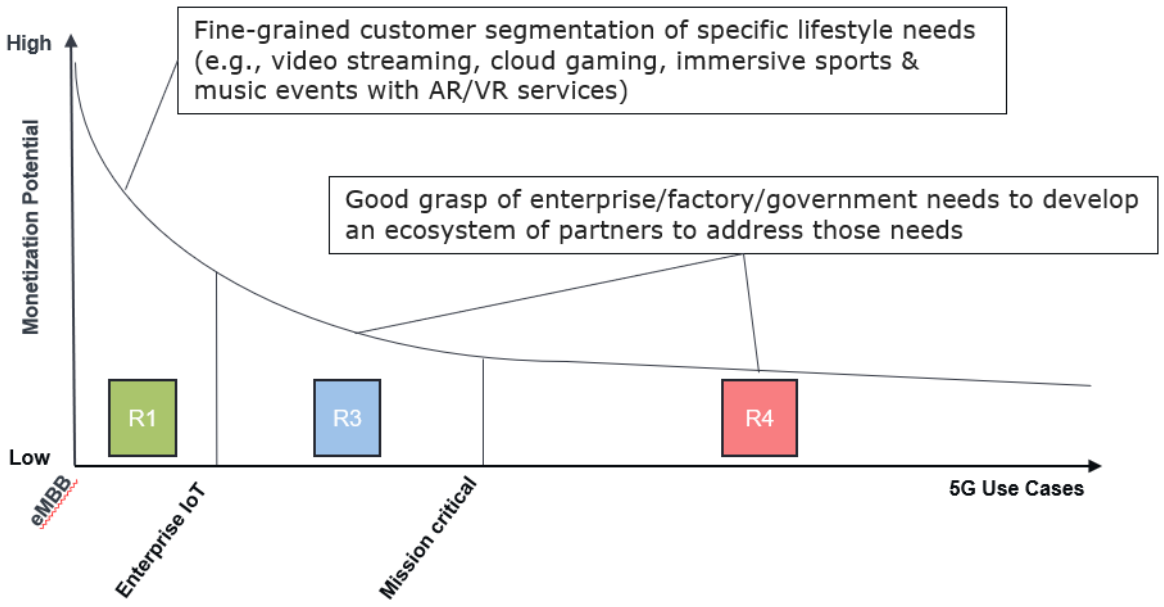
LAUNCHED AT MWC 2023, THE GSMA OPEN GATEWAY INITIATIVE SET OUT TO DELIVER UNIVERSAL NETWORK API ACCESS FOR DEVELOPERS

Backed by 21 CSPs at its debut in Barcelona, it now counts 73 CSPs representing 285 networks worldwide. Recent launches from Telefonica, Nokia, CelcomDigi and Ericsson-led Aduna demonstrate how Open Gateway APIs enable fraud mitigation and drone connectivity. According to GSMA, security and anti-fraud APIs account for two thirds of commercial deployments while APIs for mobile payments and charging such as CSP billing for pay TV or public transport account for 1% of commercially available APIs.

WE'RE STILL FAR FROM ATTACKING THE LONG TAIL OF 5G USE CASES BUT SLOWLY GETTING THERE

Published initially in February 2022 Stéphane Téral's Perspective *"The 5G money is in your pocket*," Figure 12 illustrates the long 5G monetization tail characterized by eMBB as the low hanging fruit CSPs are going after to harvest, providing consumers are willing to pay a premium for a 5G package. Then, gradually, the promised 5G use cases will eventually kick in with the expectation that by 2035, the revenue they generate will surpass that of eMBB.

Figure 12: The long 5G monetization tail, making money from humans to things



Source: TÉRAL RESEARCH

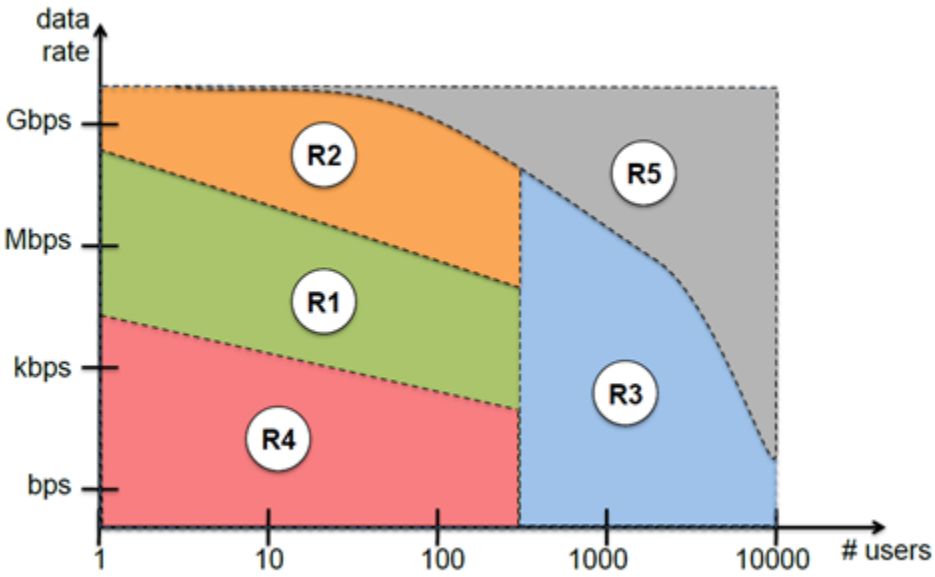
WHILE OPERATING IN REGION 1 (R1), WE'RE SLOWLY MOVING TO R3 AND R4

The framework of our analysis comes from a Bell Labs research paper released in December 2013: *Five Disruptive Technology Directions for 5G, IEEE Communications Magazine*. Figure 13 depicts Bell Labs researchers' operating regions and illustrates where cellular systems stood almost 10 years ago, which remains valid today, and how the research efforts are expanding them.

- R1 reflects the operating range of today's systems, outlining the fact that the device data rate decreases as its population increases; 5G millimeter waves and mid-band systems address this issue.
- R2 is the region that reflects current research aimed at improving the spectral efficiency, will it be 6G?
- R3 refers to massive M2M communication where each connected machine or sensor transmits small data blocks sporadically. Current systems are not designed to simultaneously serve the aggregated traffic accrued from large numbers of such devices. For instance, a current system could easily serve 5 devices at 2 Mbps each, but not 10,000 devices each requiring 1 Kbps. R3 is where 5G massive machine type communications (mMTC) use cases reside.

- R4 demarks the operation of systems that require high reliability and/or low latency, but with a relatively low average rate per device. The complete description of this region requires additional dimensions related to reliability and latency. R4 is where 5G ultra-low latency communications (uRLLC) use cases reside.
- Finally, R5 indicates the region where operation is not feasible due to fundamental physical and information-theoretical limits—Bell Labs' Claude Shannon's limit.

Figure 13: Bell Labs' 5 operating regions, Federico Boccardi et al -- 2013



Source: Five Disruptive Technology Directions for 5G, IEEE Communications Magazine

Subsidies and other incentives aimed at accelerating consumers' migration to 5G put aside, it is undeniable that a long 5G monetization journey has started. For now, and many years to come, the biggest chunk of money will continue to come from R1. Having said that, the possibilities of 5G monetization in R3 and R4 are infinite. They are finite in R1 because they rely on network migration to 5G NSA and the consumers' willingness to pay more for a 5G service, which also depends on how well the CSPs execute its consumer winning strategies.

GOOD NEWS, SOME SPECIFIC USE CASES ARE EMERGING

Here is a non-exhaustive list of 5G R1, R3 and R4 use cases that we have identified—beyond FWA and private 5G—and are significant drivers for 5G SA deployments and monetization:

- Cloud gaming and immersive media: 5G SA's low latency and differentiated connectivity have enabled commercial launches for cloud gaming services, immersive AR/VR, and live event streaming with application-based quality-of-service. These consumer-facing

experiences require advanced network features like slicing and service assurance, realized only with 5G SA.

- Event connectivity and fan experiences: operators have prioritized 5G SA rollouts to deliver enhanced connectivity and real-time interactive services at large venues (e.g., mega sporting events in Europe). These deployments leverage slicing and network APIs to provide premium mobile experiences for fans and broadcasters.
- Public safety, connected vehicles, and URLLC: use cases for ultra-reliable low-latency communications (URLLC) such as public safety (for mission-critical communications), connected vehicles (including autonomous driving, automated guided vehicles), and time-critical IoT (like remote control of machinery and robotics) have demanded new capabilities that only 5G SA delivers.
- Smart manufacturing and logistics automation: 5G SA is being deployed to address the automation of factories, warehouses, and supply chains, supporting control of industrial robots, process automation, asset tracking, and real-time analytics at scale. These industry applications benefit from network slicing and guaranteed service levels.
- Broadcast and live video production: use cases such as dynamic quality-of-service control for live video production/broadcast (enabling remote and mobile TV crews, or instant broadcaster uplinks) have prompted operators to deploy 5G SA, as these services need reliable uplink and configurable network resources.
- Banking and security: API-enabled services like bank fraud prevention (using call state and authentication APIs) illustrate how SA capabilities make entirely new business models possible, stimulating ecosystem adoption and driving deployments.
- Drones and smart mobility: management, tracking, and remote control of drones (UAVs), as well as other transport/logistics applications requiring deterministic network behavior, are cited as use cases driving 5G SA deployments.

These examples show that the adoption of 5G SA has been propelled by the need to deliver differentiated, reliable, and programmable connectivity across both consumer and enterprise verticals, especially where performance, security, and agility cannot be met by previous network generations.

A broad vendor ecosystem supports the multi-domain nature of 5G SA

Since many NFs are coming from an existing mobile core architecture such as EPC and IMS, finding the same players sounds logical. Adding NSSF and CHF to SBA brings other players into the mix, including server companies like Dell, Kontron, and Supermicro that we cover in our *Open vRAN report*. We have organized the 5G Core SBA vendor ecosystem into 6 categories:

- The traditional telecom network equipment vendors
- A few mobile core network specialists
- A handful of subscriber data management (SDM) specialists
- A truck load of policy and charging rules function (PCRF) players
- The OSS/BSS providers
- The system integrators and providers of IT services

TRADITIONAL TELECOM NETWORK EQUIPMENT VENDORS SEE 5G AS BUSINESS AS USUAL…

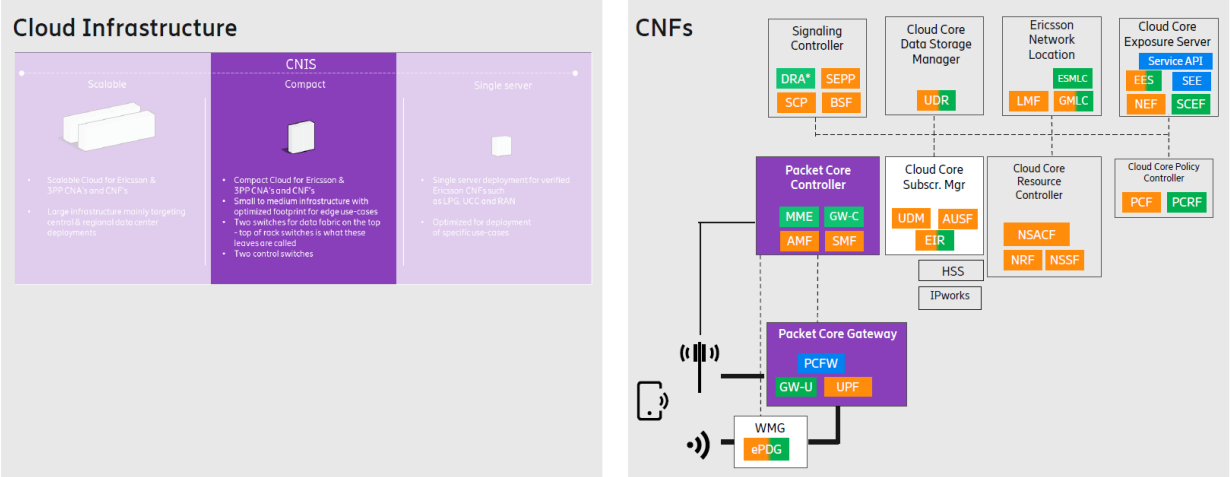
In other words, this is just another G for Ericsson, Huawei, NEC (including its Netcracker entity), Nokia, Samsung and ZTE. As described in the market share section, they all have their cloud native 5G core that supports all SBA NFs and are leveraging their SDM and PCRF products and expertise to cover all domains.

ERICSSON ADDED COMPACT PACKET CORE TO ITS PORTFOLIO AND TEAMED UP WITH GOOGLE TO TARGET PRIVATE 5G AND FWA

It sounds like Ericsson is feeling that it is falling behind Nokia. Launched in December 2024, Ericsson's Compact Packet Core is designed to simplify the transition to cloud-native infrastructure for 4G and 5G networks. As illustrated in Figure 14 below, it combines the Packet Core Controller (PCC) and Packet Core Gateway (PCG) network functions into a single, compact rack unit and leverages Ericsson's cloud-native infrastructure platform. Ericsson claims that this design reduces complexity, accelerates deployments, and optimizes operational efficiency for CSPs. The 2 deployment targets Ericsson is focusing on are:

- EPC migration: replacing legacy EPC nodes and enabling full migration of all EPC traffic to the new Compact Packet Core deployment and de-commissioning of legacy EPC nodes. Also enabling turn-on of 5GSA connecting to surrounding 5GC CNFs.
- User plane capacity expansion: enhancing capacity in current 5G core network. Compact Packet Core can be distributed at regional sites or used to complement and enhance capacity alongside central sites.

Figure 14: Ericsson's Compact Packet Core



Source: Ericsson

This complements Ericsson's dual mode 5G core, the company's flagship product that groups NFs per network services to allow deployment flexibility. Named Cloud Packet Core, the platform combines EPC and 5G core functions into a cloud-native common platform that supports 5G NSA, 5G SA, 2G, 3G and 4G, and provides much needed backward compatibility as 2G/3G and 4G won't go away anytime soon. Key features include cloud-native 5G core NF microservices, 4G EPC NFs re-architected into cloud-native ones with secure parity, full interworking with legacy networks, and enterprise offerings.

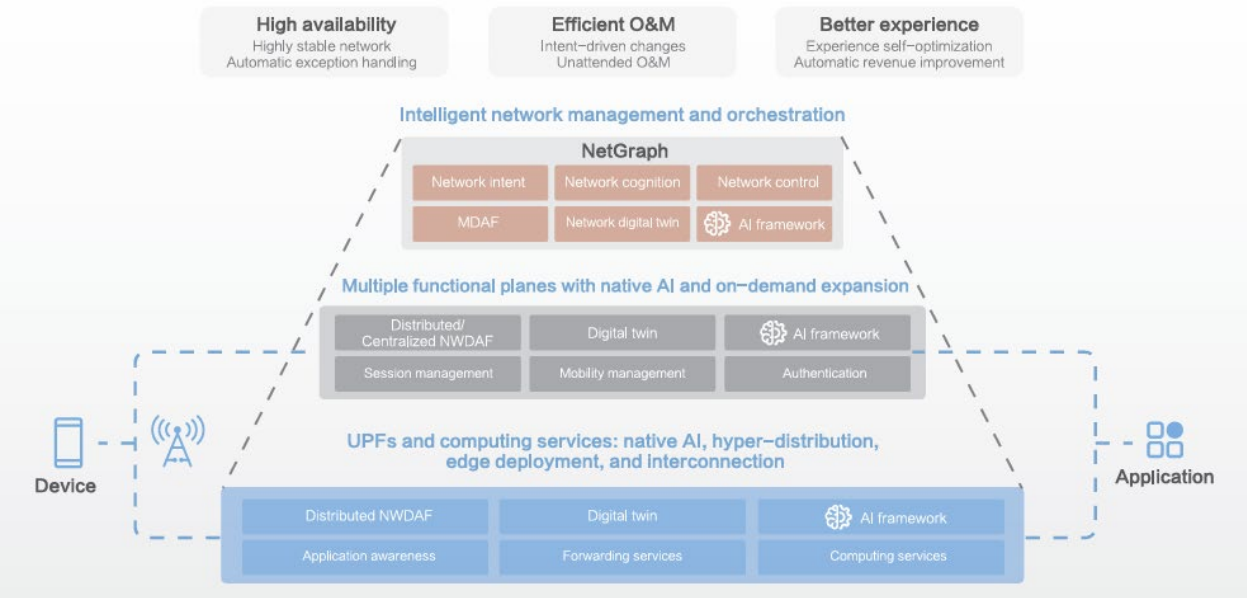
In June 2025, Ericsson announced it was putting its full 5G core stack in Google Cloud as part of its new On-Demand offering. Unveiled during the company's 5G Core Summit in Madrid, Ericsson On-Demand provides network core capabilities via a pay-as-you-grow SaaS model. Built with Google Kubernetes Engine with both control and user plane running on Google Cloud infrastructure, it will be managed by Ericsson. The product will initially be aimed at private wireless deployments and fixed wireless applications. Internet of Things, MVNOs, hybrid cloud capacity offload and hybrid disaster recovery were also listed as future use cases in an Ericsson presentation.

HUAWEI'S 5.5G CLOUD-NATIVE CORE HAS EVOLVED TO AI CORE

Launched at MWC24, Huawei's 5.5G cloud-native converged core platform is based on the concept of strengthening the current network building blocks that paved the way to where we are today, and continuously adding new capabilities and enhancing them to enable all services needed to address the plethora of new 5G use cases. At MWC25, Huawei presented an evolution of its platform, including its Telco Intelligent Converged Cloud, with the integration of

AI at every layer: AI Core. It's worth mentioning that most of the development was achieved through collaboration with China Mobile Zhejiang.

Figure 15: Huawei's AI core overall architecture



Source: Huawei Technologies

Huawei's AI core design is based on 3GPP specifications and leverages both the Network Data Analytics Function (NWDAF) and Management Data Analytics Function (MDAF) to create a 2-level on-demand scheduling between intelligent services and continuous enhancement of network stickiness. The NWDAF as well as training, analysis and inference functions can be deployed in both centralized and distributed manners. The centralized NWDAF and MDAF support training, retraining, analysis and inference functions. The application function (AF) provides analysis data input to NWDAF and MDAF through the NEF.

Huawei plans to roll out its AI Core network in two phases:

1. 5G-A Intelligent Core: integrates AI agents to enhance intelligent network capabilities. Additionally, by introducing computing-network convergence, the network can boost intelligent computing capabilities for terminals while overcoming their computing power and energy efficiency constraints.
2. Agentic core: by leveraging the AI-based architecture, the network will become autonomous and capable of self-optimization and self-O&M; it will dynamically adapt to diverse real-time service needs.

Huawei has developed 3 types of AI agents:

- Calling agents process multi-modal inputs (voice, video, gestures) to transform traditional dial pads into intent-driven task managers, facilitating one-stop closed-loop of service tasks and capturing service entry opportunities.
- Personalized experience agents dynamically schedule network resources for differentiated user experiences, redefining user experience, providing operators with an entry to experience monetization.
- Digital expert agents resolve complaints and alarms via natural language interaction and AI inference, streamlining O&M through a unified portal.

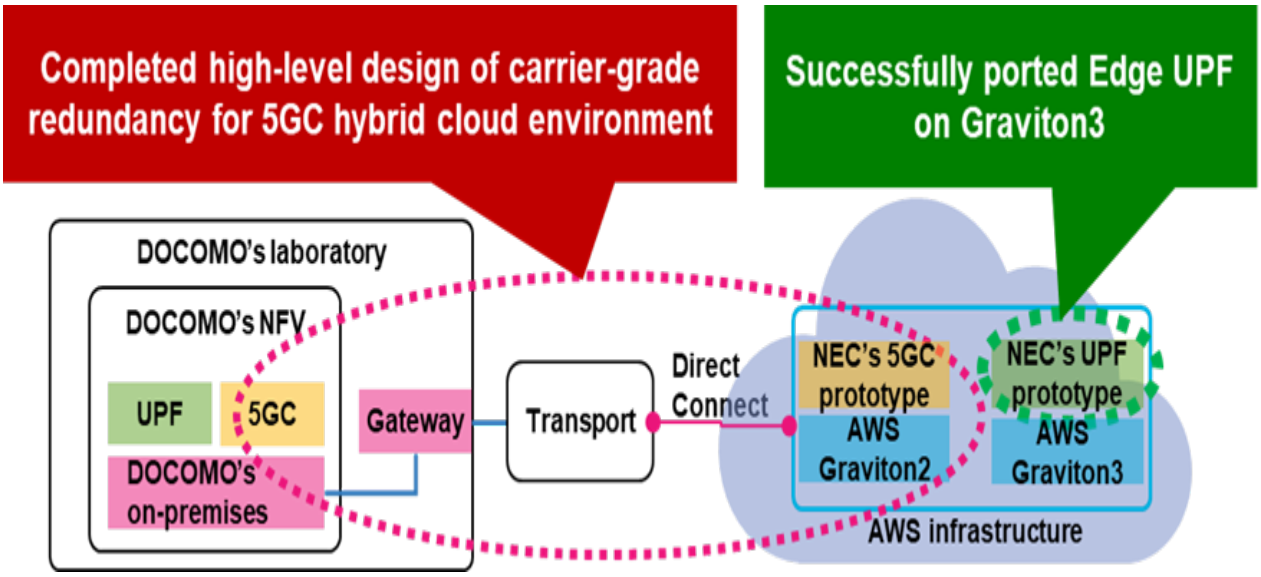
NEC AND RAKUTEN MOBILE PIONEERED A "MADE IN JAPAN" 5G CORE, WHICH THEN WAS SELECTED BY DOCOMO

Little has changed at NEC. After 5 years of joint development with Rakuten Mobile, NEC's core solution is platform-agnostic and therefore adaptable to customer requirements, whether private, public, or hybrid cloud (on-premises, edge, or cloud), while also ensuring optimum performance. NEC Core is certified on Red Hat OpenShift, VMware, Robin.io (part of Rakuten Symphony), AWS and Wind River (User-Plane only). The chronology of the key events that led to this current platform is as follows:

- June 2020: NEC started jointly developing with Rakuten Mobile a cloud-native containerized 5G SA core network, which was deployed in Rakuten Mobile's virtual network in Japan. In June 2021, NEC ran a successful lab test of the containerized UPF function. The 2 companies built a "made in Japan" 5G core based on NEC's homemade software source code. This 5G core was initially offered as an application on the Rakuten Communications Platform (RCP) Marketplace, allowing customers to quickly and easily "click, purchase and deploy" a fully virtualized 5G SA core network solution.
- November 2020: NTT docomo selected NEC for the development of its 5G SA mobile core network, which went live in December 2021. As part of the deal, NEC also provided NTT docomo with a compact data processor, which it called the "UPF mini" that was placed at edge locations. The UPF mini offers smaller-sized computing resources to process applications at the edge, isolated from other processes on the operating system
- February 2022, RCP morphed into Symworld as a key Rakuten Symphony offering (see Stéphane Téral's Perspective *"MWC22: How Rakuten Symphony stole the show and the innovation driver's seat."*) It's also worth mentioning that NEC's Netcracker supplied the OSS/BSS to Rakuten Mobile.
- February 2023: NTT docomo and NEC announced the completion of their joint effort to produce a carrier-grade redundancy 5GC design in a hybrid-cloud environment that leverages both AWS and docomo's on-premises NFV infrastructure (Figure 16). This design allows docomo to switch between docomo's on-premises NFV and AWS infrastructure for 5GC redundancy operations, which in turn offers a more flexible and cost-effective means to manage network performance and capacity. The companies said that use of the Graviton2 processor cut the energy consumption by 72% and the

throughput per CPU saw a 20% improvement compared with a UPF running on a conventional architecture.

Figure 16: docomo's and NEC's 5G SA cloud-native Core



Source: NEC

The latest news we gathered at MWC24 last year include:

- NEC launched a new beyond 5G/6G era UPF for CSPs and achieved 1.3Tbps throughput.
- UK-based CSP Clear Mobitel deployed NEC's 5G SA cloud-native core in the U.K. and the Channel Islands.

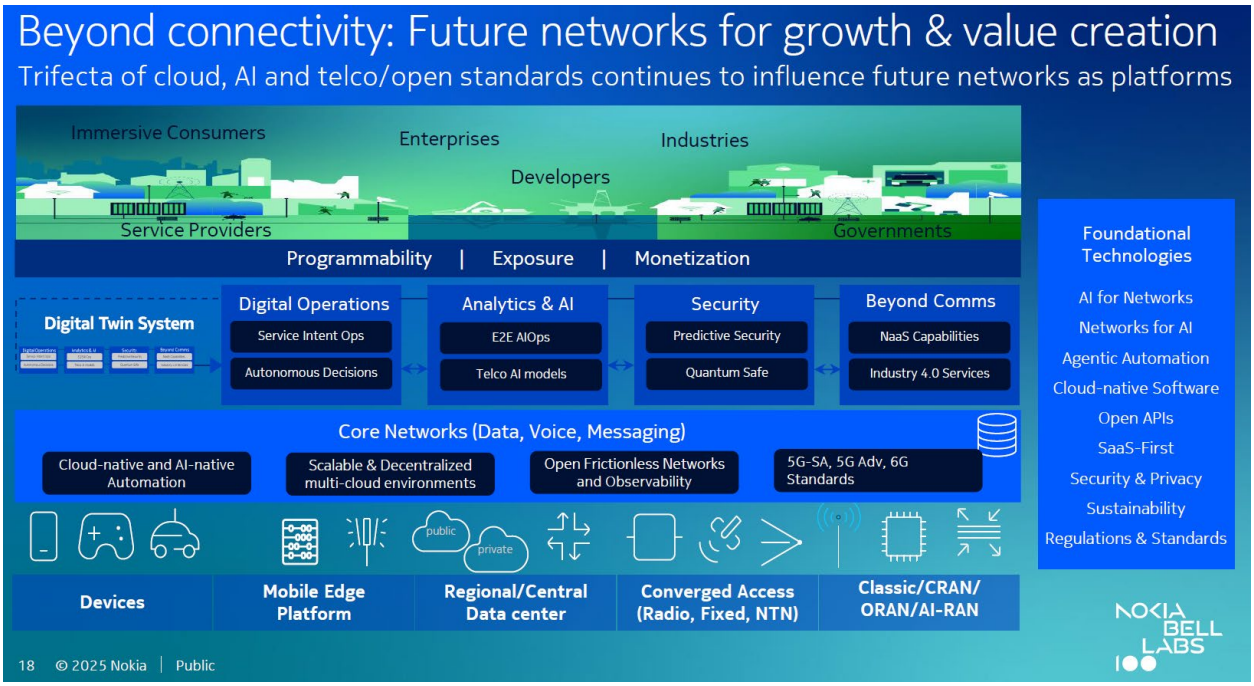
NOKIA LOOKS BEYOND CONNECTIVITY WITH A CORE FOR EVERYTHING

Nokia is actively pursuing strategies that extend beyond its traditional focus on connectivity, particularly in areas like autonomous networks, cloud technology, and artificial intelligence. This shift aligns with the evolution of 5G and the broader digital transformation, where AI and automation are becoming increasingly crucial. Nokia is also expanding its presence in private wireless solutions, including private 5G networks, and is developing innovative solutions for industrial applications leveraging AI and edge computing.

To support this vision, Nokia's cloud-native core serves all mobile generations (2G/3G, 4G, 5G NSA, 5G SA), unlicensed spectrum (e.g., WiFi, CBRS), and converged access (i.e., radio, fixed, NTN) (Figure 17). Its core is cloud-native across all mobile generations, including Packet Core, SDM, Policy, Charging, NWDAF, NEF and IMS. Consequently, CSPs and enterprises benefit by deploying their entire core on the cloud platform of their choice, without having to segregate the

deployment into separate cloud platforms for VNFs versus CNFs, thus gaining the operational benefits of a shared cloud platform.

Figure 17: Nokia's vision of future networks



Source: Nokia Bell Labs

Nokia's cloud-native maturity is shown in its multi-cloud strategy with deployments of its mobile core and IMS core directly on hyperscalers' clouds, in addition to deployments on Red Hat OCP, VMware Tanzu, Rakuten Cloud Platform, etc. Publicly announced deployments of its mobile core and IMS core, which are in live commercial service on hyperscaler clouds, include Boost Mobile US (AWS), Comcast US (AWS), Telenet Belgium (Google), Telefonica Germany (AWS, Google), plus several instances of its Core SaaS on AWS for Telia Sirius Finland, Elisa Finland (Tampere Stadium), Citymesh Belgium, etc.

Nokia's programs for 5G SA Core & Autonomous Networks empower CSPs to unlock simplicity, in that it is secure by design, provides automation at scale, and has AI-driven autonomy. All this includes:

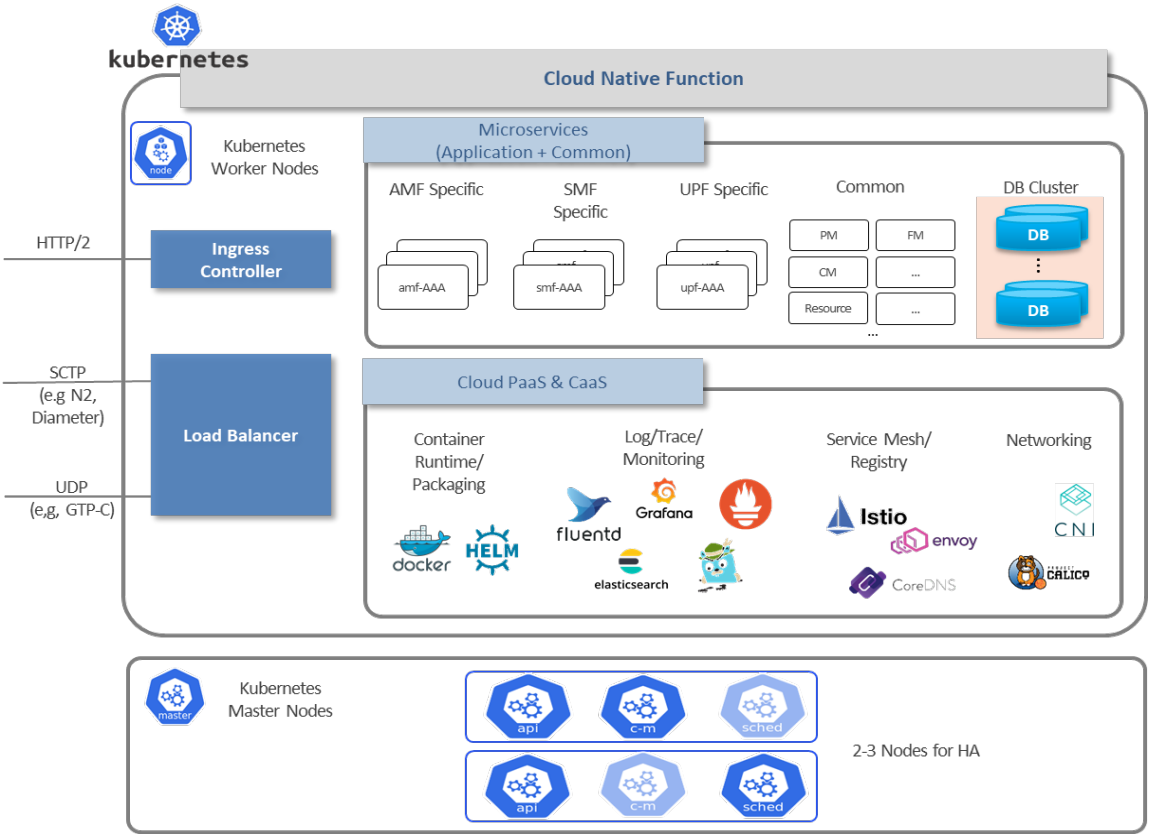
- AI-powered anomaly detection with Nokia NetGuard's Edge Detection & Response (EDR), which deploys specialized endpoint agents and network sensors in Core CNFs to deliver deep, real-time visibility into critical telco network functions, without any dependencies on kernel level, and no impact on network function performance or capacity.

- Launched in June 2025 at Nokia Core User Group and TM Forum's DTW in Copenhagen, Nokia's Autonomous Network Fabric brings explainable AI and 360-degree observability. It enables the total orchestration of complex, cross-domain processes through AI-driven decision-making, self-learning and adaptability, with little human involvement needed. This includes TM Forum's Level 4+ autonomy across multi-vendor core, radio, transport, and across network operations, subscriber experience, security, etc. A catalog of Autonomous Networks applications would access the Autonomous Network Fabric's services via APIs, for security, automation, analytics, etc.
- Nokia's 5G SA Core & IMS Core, functioning as warm standby cores deployed on AWS, scale in 20 minutes from a small instance to millions of subscribers. AI/ML-enabled AMF predicts and manages demand spikes during recovery. Use-cases include mass calling events, disaster recovery in the cloud, etc.
- Nokia Cloud Operations Manager Evolved (NCOM Evo) provides the core with fully automated lifecycle & configuration management with GitOps.
- Nokia Core Monitor & Troubleshooter (NCMT) manages Core CNFs and the cloud platform, providing automated fault detection & troubleshooting, using cloud-native open-source tools. It provides deep drill-down for easy troubleshooting, plus unified observability of the Core CNFs and cloud. It is extensible to fit with the CSP's OSS layer, including Nokia Digital Operations Center and other vendors' OSS.
- Simplified IMS for lower TCO by integrating most IMS functions within a single CNF, in Nokia's Cloud Native Communication Suite (CNCS). It deploys in 1 hour, ISSU in 2.5 hours, 3x-4x reduction of CNFs to be managed, 10%-20% reduced footprint compared to distributed IMS.

SAMSUNG LAUNCHED A "MADE IN KOREA" 5G CORE BACK IN 2017

As the vendor announced the commercial availability of its next generation 5G core solution at MWC 2017 along with a library of 5G VNFs, it positioned itself as another 5GC pioneer. Samsung's next generation 5G core was successfully tested by SK telecom and has since been deployed in South Korea by the 3 local CSPs (KT, LG U+ and SK telecom). In October 2020, Samsung created containerized network functions, which led to the development of its current cloud-native 5G SA core that supports both 4G and 5G (Figure 18).

Figure 18: Samsung's cloud-native 5G core



Source: Samsung

In February 2023, KDDI, a long time Samsung customer, selected the vendor's cloud-native 5G core for the operator's commercial network across Japan. Although we believe Samsung's total number of 5G core contracts does not exceed 10; Telus in Canada is the most recent win.

ZTE INTRODUCED ITS AIR CORE PLATFORM AT MWC25

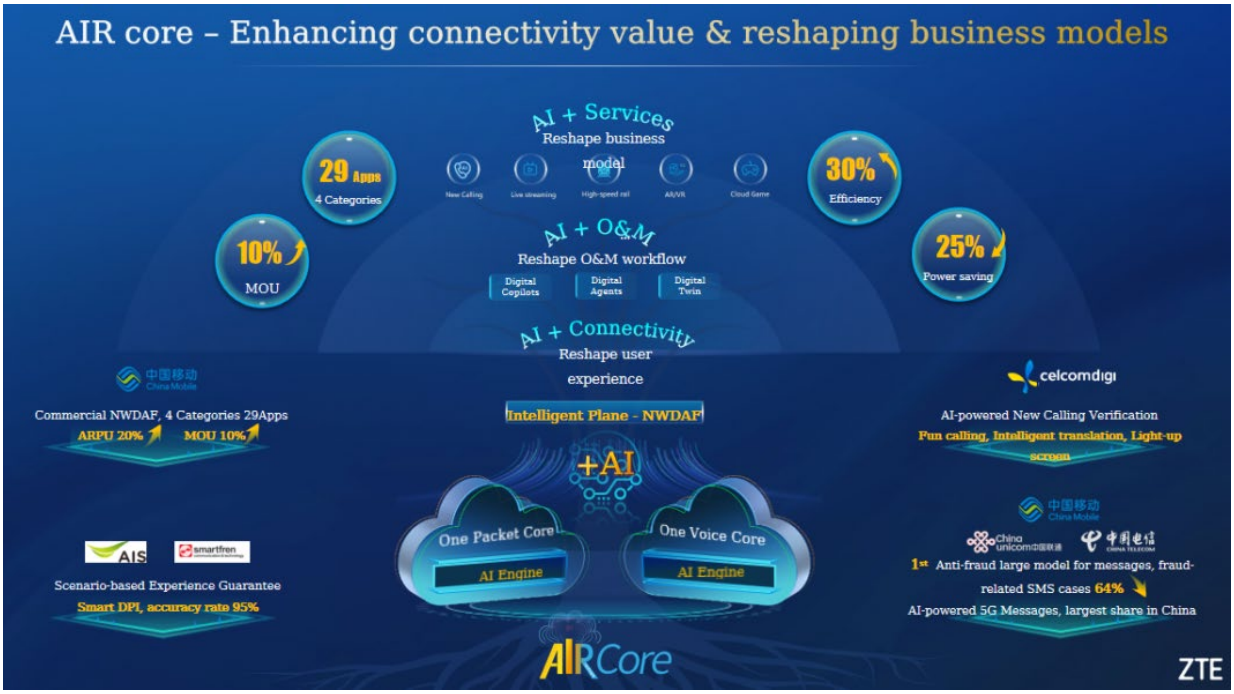
This is an evolution of ZTE's 5G Common Core Solution launched at MWC 2018, which is a common mobile core platform that supports all VNFs. ZTE's common core platform supports all Gs including 5G NSA and 5G SA, CDMA, Wi-Fi and fixed access deployments, and provides full convergence of control plane, user plane, and voice and user data to reduce signaling interaction. It is cloud-native by design and uses open microservices components, a carrier-grade visual DevOps tool and container technology.

In this cloud era, cloud-native empowers elastic, agile, and automated networks while in the AI era, ZTE believes core network will continue to evolve from cloud-native to AI-native. The vendor claims that AI-driven networks will become intelligent in all aspects, promoting the transformation of networks into intent-driven, agent, and higher-order autonomous networks. As

a result, ZTE launched an AIR (AI Reshaping) core platform that provides service intelligence, creates new connection values in connection intelligence, and builds a highly resilient network in operation and maintenance intelligence, through diversified AI capabilities such as multi-mode communication, large language models, and digital twins. Besides, core for AI can provide AI with one-stop ubiquitous intelligent computing power, an out-of-the-box model, and an efficient network. ZTE integrates AI/ML with 5G Core in three key areas: AI+ Connectivity, AI+ Service, and AI+ O&M (Figure 19):

(1) AI+ Connectivity: enhance the control plane and user plane of the 5G core network by introducing large network models, improving user experience, and enhancing data value.
(2) AI+ Services enhance messaging and new calling with interactive, intelligent, and immersive experiences.
(3) AI+ O&M reshapes the operations paradigm, supporting the evolution of autonomous and intelligent networks toward unmanned operations.

Figure 19: ZTE's cloud core portfolio



Source: ZTE

ZTE AIR core has been commercially deployed in China Mobile for large scale. ZTE's full-stack intelligent computing solutions enable operators to quickly build AI-driven computing platforms, providing customized services for users and seizing new opportunities in the AI-driven digital economy.

…SO DO MOBILE CORE NETWORK SPECIALISTS CISCO AND MAVENIR

Since Microsoft's departure after divesting Affirmed Networks and Metaswitch in June 2024, Cisco and Mavenir are the only 2 specialists with a global presence left in this category. It's also worth mentioning that the US assault on Huawei characterized by the relentless pressure on Western countries and US allies to remove the Chinese giant from 5G rollouts has somehow benefited a few of these core network specialists. Case in point: in 1H20, Telecom Italia Mobile (TIM) excluded Huawei from its 5G core tender process and invited Affirmed Networks, Cisco and Mavenir to bid, along with Ericsson and Nokia. In June 2021, TIM launched the first 5G cloud in Italy by using its own Telco Cloud infrastructure, Google's Cloud solutions and Ericsson's 5G Core network and Automation technologies.

CISCO'S STRATEGY FOR 5G CORE IS A PURE SOFTWARE PLAY WITH AN EYE ON PRIVATE 5G WIRELESS NETWORKS

While Cisco has been busy focusing on sustaining its EPC/vEPC business, it has not aggressively targeted CSPs with its 5G offering. Cisco Ultra Services Platform is the name of the family of mobile core network software products. It includes its flagship ASR 5500 Series packet core, which enables all virtualized packet core functions, and features Ultra Cloud Core, a new cloud-native packet core platform that supports secured 3G/4G/5G/IoT/WiFi connected services. Ultra Cloud Core has advanced CUPS capabilities that support multi-access edge computing and can be instantiated in any cloud environment. It is purpose built based on a common component architecture equipped with automation for fast time-to-market. Cisco's major mobile packet core developments include:

- T-Mobile US was the first major CSP to introduce Cisco's 4G CUPS in the EPC at production scale in 2018, and that quickly led to the introduction of a 5G SA core. Within T-Mobile's 5G core, Cisco provides 3 primary NF: the user plane, session management, and policy control functions. Those network functions run on Cisco servers, switching, and its virtualization orchestration stack.
- As a longtime leader in switching and routing, Cisco looks at 5G core from a router perspective: 5G traffic is coming in through the backhaul infrastructure, in which Cisco is also a player, and hits the IP core. The Cisco 8000 is started at the IP core network that connects to the mobile core. As a result, with strong leadership and expertise in IP, backhaul, and mobile core, the company thinks it has a significant competitive advantage against anyone else in the industry with capacity, significant power savings, and 5G deployment acceleration.
- In February 2023, Cisco and Intel revealed they have teamed up on private 5G for enterprise and IoT use cases. Cisco and Intel announced they would create reference architectures for 5G services that could be used for IoT, manufacturing, supply chain, or smart sites. The companies said they would make the architectures available to managed service provider partners. Cisco's subscription-based private-5G managed

service includes its mobile core technology and its IoT portfolio, which itself includes Cisco IoT Control Center and Cisco P5G Packet Core as well as IoT sensors and gateways. It also includes device-management software and monitoring tools, all available via a single portal.

- In October 2023, Cisco completed the acquisition of Working Group 2 (WG2), a Norway-based software vendor that spun from Telenor in 2017 to develop a cloud-native programmable mobile core platform that is offered as-a-service to CSPs. WG2 is now part of the Cisco Mobility Platform and boosts Cisco's edge deployment and API first strategy for application development partners, enterprise customers and CSP partners. WG2's mobile industry expertise greatly augments Cisco's enterprise market leadership with new capabilities such as authentication, provisioning, voice, messaging and data services that have been rolled in the Cisco Networking Cloud, Assurance, Security, and Collaboration portfolios.

MAVENIR BRINGS MORE THAN 15 YEARS OF CORE NETWORKS EXPERTISE AND IS CHALLENGING THE TRADITIONAL EQUIPMENT VENDORS

Overall, many Tier-1 CSPs see Mavenir as a top mobile packet core vendor; case in point: the vendor boasts Deutsche Telekom in Germany and other European properties, and Vodafone in Portugal and other European properties as its top Tier-1 CSP customers. In Germany, Mavenir is also supplying 1&1 Drillish with its entire core portfolio and has also publicly referenced other customers including Ice/Lyse Norway, Magyar Telekom, T-Mobile Slovakia, T-Mobile Czechia, Paradise, Terrestar, e& UAE, Tempnet, Oxio and Eolo Italy. The company first reported 5G core SBA revenues in 2020 and as a result appears among the traditional vendors, just 3 years after launching a full suite of mobile core network functions. Some of the most recent public announcements include:

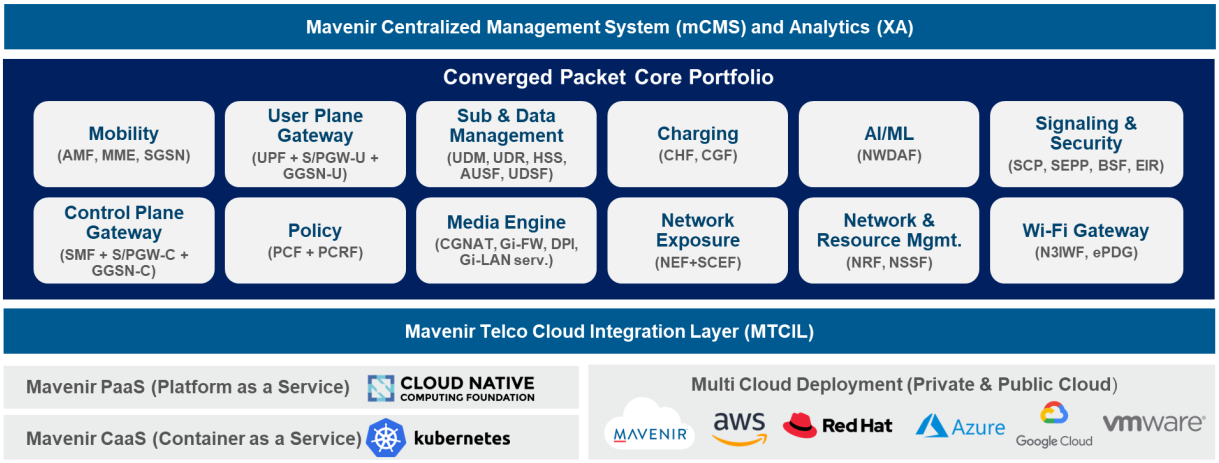
- In February 2024, **Slovak Telekom** chose Mavenir's Converged Packet Core in Core Supply Partnership. Mavenir was already delivering voice and messaging services for the Slovakian operator and is now providing data services across the packet core domain for "all Gs", deploying into Slovak Telekom's private Container-as-a-Service (CaaS) cloud platform. The new agreement also involves Mavenir to integrate next-generation capabilities for cloud-native 5G SA.
- In February 2024, **T-Mobile Czech** Selected Mavenir for Cloud Native Converged Packet Core Solution. Mavenir has been implementing converged packet core solution into T-Mobile Czech's own Container-as-a-Service (CaaS) cloud platform and replacing existing vendor access technologies across 2G, 3G, 4G and 5G NSA as well as building capabilities to serve cloud-native 5G SA.
- In October 2024, Mavenir 5G Core powered **ICE Norway's** network slicing for Norwegian Armed Forces. ICE is utilizing its new 5G SA network to provide a dedicated network slice for the Norwegian Armed Forces, designed to deliver the specific service levels required by military communications. Essentially an isolated network-within-a-

network, the Armed Forces will have exclusive use and control over their slice nationwide. It will be able to establish secure end-to-end communications across the network.

- In February 2025, Italian Operator **EOLO** Selects Mavenir 5G SA Core for Europe's First 5G Standalone mmWave FWA Network. The deployment is among the world's first 5G standalone FWA networks using mmWave and will deliver cost-effective ultrafast broadband internet access to areas across Italy not reached by fiber connectivity. Mavenir's 5G SA Core was selected by EOLO for its outstanding levels of flexibility and interoperability.
- In February 2025, Mavenir and **Terrestar** successfully completed a Voice over NB-IoT (Narrowband Internet of Things) call in NTN (Non-Terrestrial Networks) mode. The achievement was conducted over a 3GPP-standardized NTN S-band spectrum to avoid interference common in terrestrial networks.
- In February 2025, Mavenir and **OXIO,** a next generation of MVNOs, deployed a packet core that enables 4G and 5G user connectivity with an open, cloud-native, container-based solution, along with Mavenir's IMS and messaging platforms for A2P and B2C segments.
- In March 2025, Mavenir and **e& UAE** announced a multi-year strategic technology partnership at MWC25 to start with collaboration in converged 5G packet core. This long-term partnership leverages cutting-edge technologies and advanced features, including AI-enabled 5G services, automation, and orchestration.
- In May 2025, Mavenir announced a converged packet core with **Tampnet** to deliver innovative, cloud-native 5G services to its mobile customers, including eMBB, URLLC, and mMTC. Leveraging full containerization for optimal flexibility, Mavenir's advanced converged packet core solution will ensure a smooth and seamless transition across Tampnet's 4G, 5G NSA, and the introduction of 5G SA while also preparing the network for future 6G capabilities.

As of end Q1 2025, Mavenir has more than 130 customers across the entire Converged Packet Core product portfolio. Customer use cases span across 5G SA eMBB, 2G/3G4G/5G converged packet core, IoT, FWA, packet core for VoWiFi and VoLTE support, MVNO/MVNE enablement, network slicing, private (campus) networks, and NTN.

Figure 20: Mavenir's Converged Packet Core Portfolio

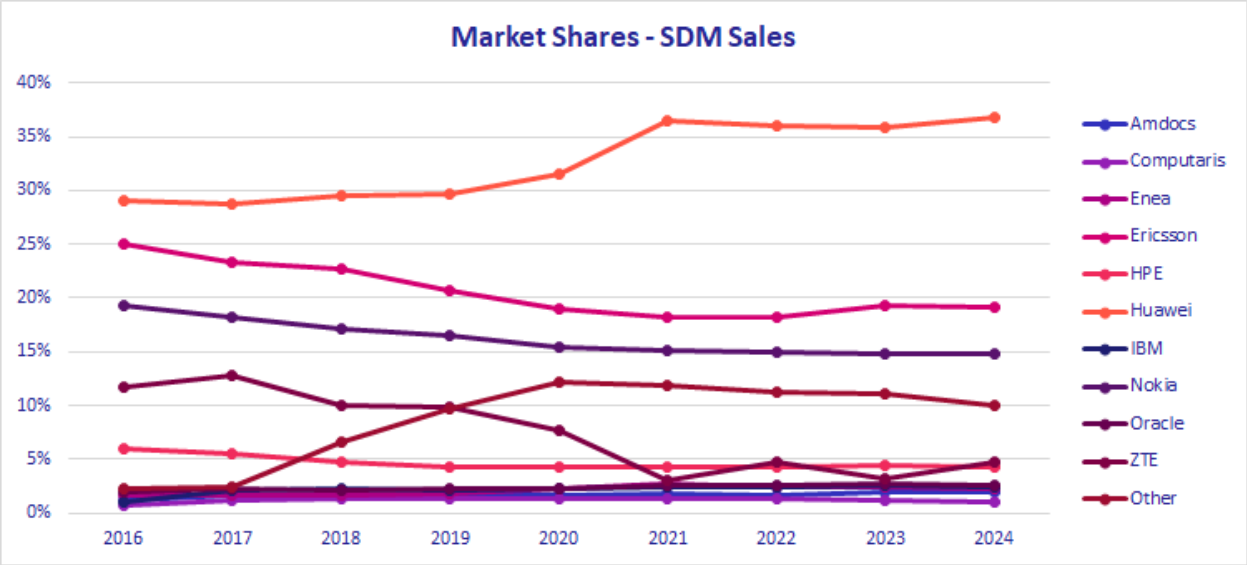


Source: Mavenir

THE LIST OF SDM SPECIALISTS IS SHORT BUT SOLID

This is because Huawei, Ericsson, Nokia are already the major players in this category as major suppliers of HLR and HSS controlling 71% of the SDM market that includes HLR/ngHLR/HSS and 5G UDM/UDR/UDC/AUSF/FE software and services sales; ZTE is next with a 5% sales share. The rest of the list is made of HPE, 1 true SDM specialist, Enea, late arriving HLR player Computaris, OSS/BSS leader Amdocs, and 2 IT software powerhouses: IBM and Oracle. Since this segment is directly linked to subscribers and connections, it enjoys the strongest stickiness with the usual vendor, and little has changed over the past 5 years; except that Huawei, supported by its huge domestic market of 1.8B subscribers, has been maintaining its 36/37% share since 2021 (see Excel file). As mentioned in the beginning of this report, the 5G data management component, which is a subset derived from SDM, posted 18% YoY growth in 2024.

Figure 21: SDM Vendor Sales Market Shares



Source: TÉRAL RESEARCH

ENEA IS A 56-YEAR-OLD SWEDISH COMPANY THAT HAS DATA STORAGE AND OPERATING SYSTEMS IN ITS DNA

At the beginning of the last decade, Enea reinvented itself to focus on open-source software based SDM. The company acquired network management system and service orchestration vendor Centered Logic and network intelligence software company Qosmos, both in 2016; mobile video traffic management Openwave Mobility in 2018, and a business unit from Atos Convergence Creators with leading positions in policy management, authentication, and subscriber data management in 2019.

Openwave Mobility's mobile traffic management platform was designed for mobile operators to manage and monetize encrypted and unencrypted traffic, a similar technology that Qosmos developed and was deployed by 7 of the top 20 mobile operators worldwide. However, it's Openwave Mobility's portfolio of cloud-native SDM solutions that formed the foundation of who Enea is today: a true SDM/UDM pure-play. Today, Enea's telecom products include the Stratum Network Data layer, 5G Service Engine, Subscription Manager and Policy Manager, providing a range of subscriber data management, authorization, and traffic management capabilities for both 4G & 5G mobile environments:

- Unified Data Manager (UDM) that manages all aspects of 5G subscriptions, providing data privacy and security modules: Authentication Credential Repository and Processing Function (ARPF) and Subscriber Identify De-concealing Function (SIDF)

- Enea Stratum (UDR/UDSF): an open cloud-native 5G network data layer that aggregates, consolidates and manages all service provider data on one single platform, provides the Enea Access Manager (AUSF) and Enea Policy Manager (PCF) functions
- 5G Equipment Identity Register (EIR) that authenticates mobile and IoT devices in the network to prevent the misuse and abuse of paid services

In February 2023, Enea launched a new Policy Manager network function, a dual-mode policy control function to enable operators to develop diverse policy use cases for subscribers and IoT devices in cloud-native deployments. The Enea dual-mode Policy Manager utilizes the cost and consistency benefits of a single, common subscriber profile, as well as the scale to handle real time policy decisions in 4G and 5G.

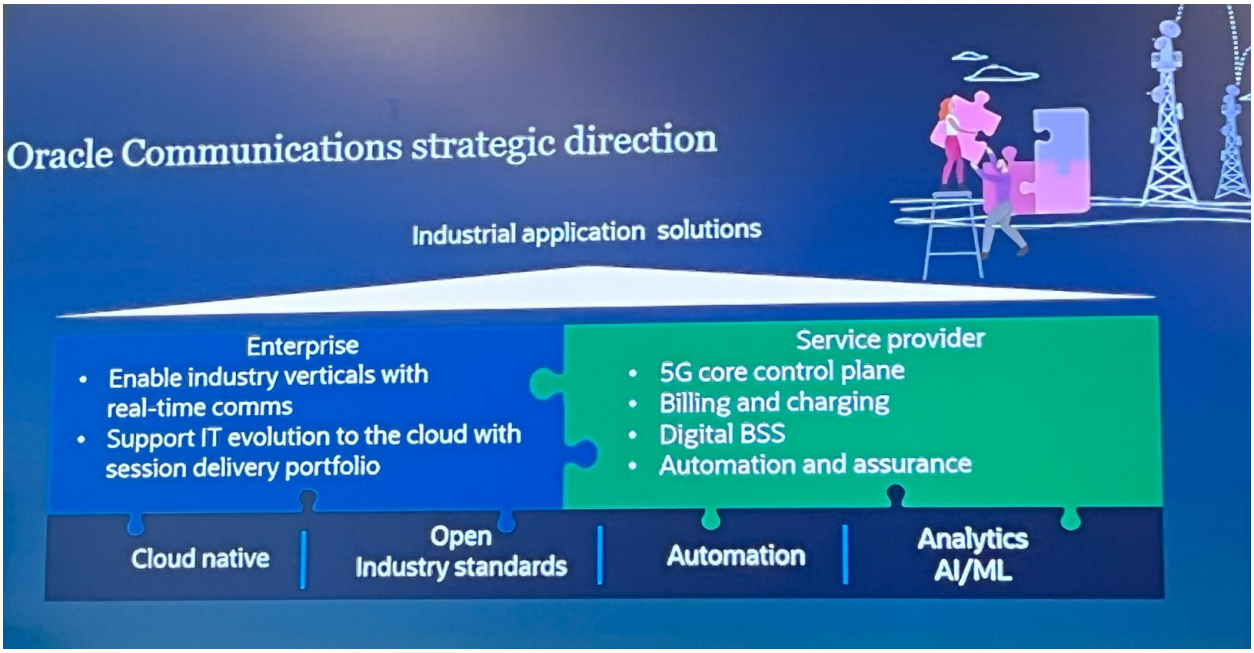
ORACLE FIRES ALL CYLINDERS TO HELP TELCOS MONETIZE 5G

Like HPE, Oracle does not provide session and user plane NFs (e.g., AMF, SMF, UPF) and relies on partners and third parties for these components. Leveraging its 2013 Tekelec acquisition, Oracle focuses on building only the components that the company knows it will excel at, and perhaps more importantly, represent the most critical components of a CSP's 5G network. Case in point: routing and selection (e.g., NRF, NSSF, NEF, SEPP, SCP), policy and charging (PCF including 4G/5G converged policy, CHF, BSF, UDR/UDSF/SLF/EIR), and network analytics (NWDAF, Data Director) are one of the 3 pillars of Oracle Communications. At its Analyst Summit in April 2024, the vendor told us that it leverages its Oracle Cloud Infrastructure (OCI) and enterprise expertise to help CSPs find new revenue opportunities (see *Oracle Communications fires all cylinders to crack the CSPs monetization puzzle*).

As Oracle successfully helped enterprises to migrate to the cloud, the company believes that it can apply its ECP playbook to the CSP domain, and add real-time data generated from the network to drive the monetization of new services. By doing this and staying focused on the chief monetization mechanisms that 5G offers—5G core control plane, billing & charging, automation & assurance, and digital BSS—Oracle is confident that it can greatly influence the monetization process and scale the creation of new business models and services.

Oracle's 5G core offerings are commercially available and tested/deployed by a dozen Tier-1 CSPs including BT, Boost Mobile, KT, Orange, Rakuten Mobile and Vodafone as well as others that are under NDA are shown in Figure 22 below. The vendor is also involved in a flurry of PoCs with CSPs worldwide.

Figure 22: Oracle Communications Cloud Native Core 5G Network Functions



Source: Oracle Communications

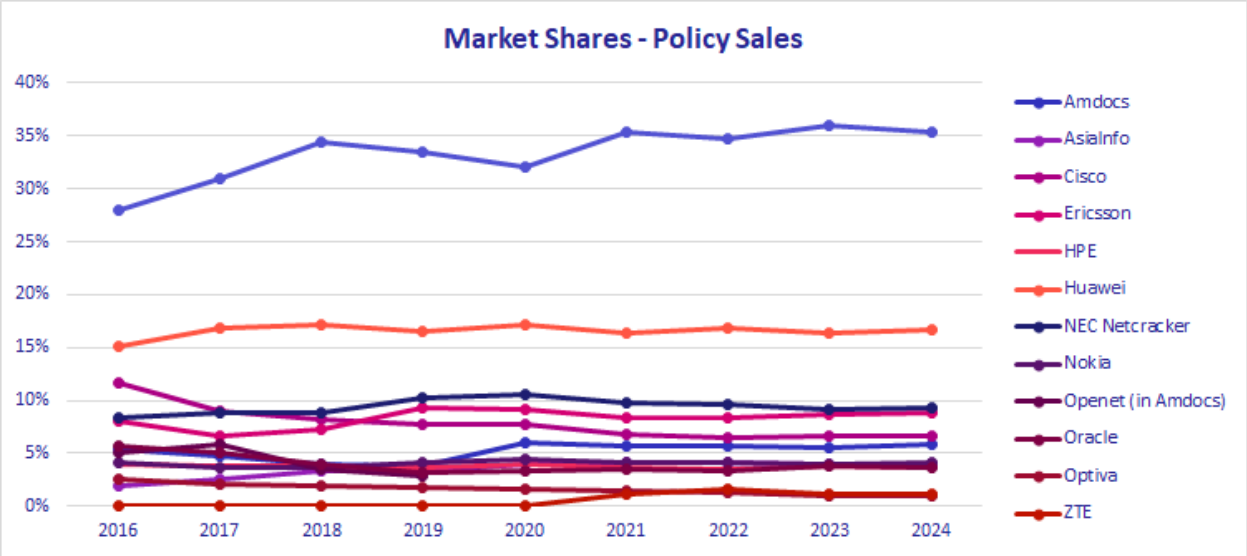
BY CONTRAST, THE LIST OF PCRF VENDORS IS VERY LONG

The fragmented $3.8B PCRF market, which stayed flat YoY, is characterized by an ecosystem that includes at least 20 vendors which we categorized as follows:

- Traditional network equipment vendors: Ericsson, Huawei, Nokia, and ZTE
- Mobile core/IP router vendor: Cisco
- SDM vendors: Enea, HPE, and Oracle
- PCRF pure-play specialists: DigitalRoute, FTS (Magic Software Group), Intracom Telecom, Magnaquest Technologies, Mahindra Comviva, MATRIXX Software, Nexign, and Openet (now part of Amdocs)
- OSS/BSS vendors: Alepo, Amdocs, Cerillion, CSG International, Hansen Technologies, NEC's Netcracker, and Optiva

As a result of this deep fragmentation, Huawei, NEC Netcracker, Ericsson, and Cisco, respectively, all together command 42% of the global PCRF revenue market, followed by Amdocs (6%) (acquired Openet in 2020), HPE (4%), Nokia (4%), Oracle (4%), AsianInfo (4%), Optiva (1%) and ZTE (1%). Our estimates—no one provides revenue data—indicate all the other vendors cited above make up the rest in the Other category (35%).

Figure 23: vPCRF Vendor Sales Market Shares

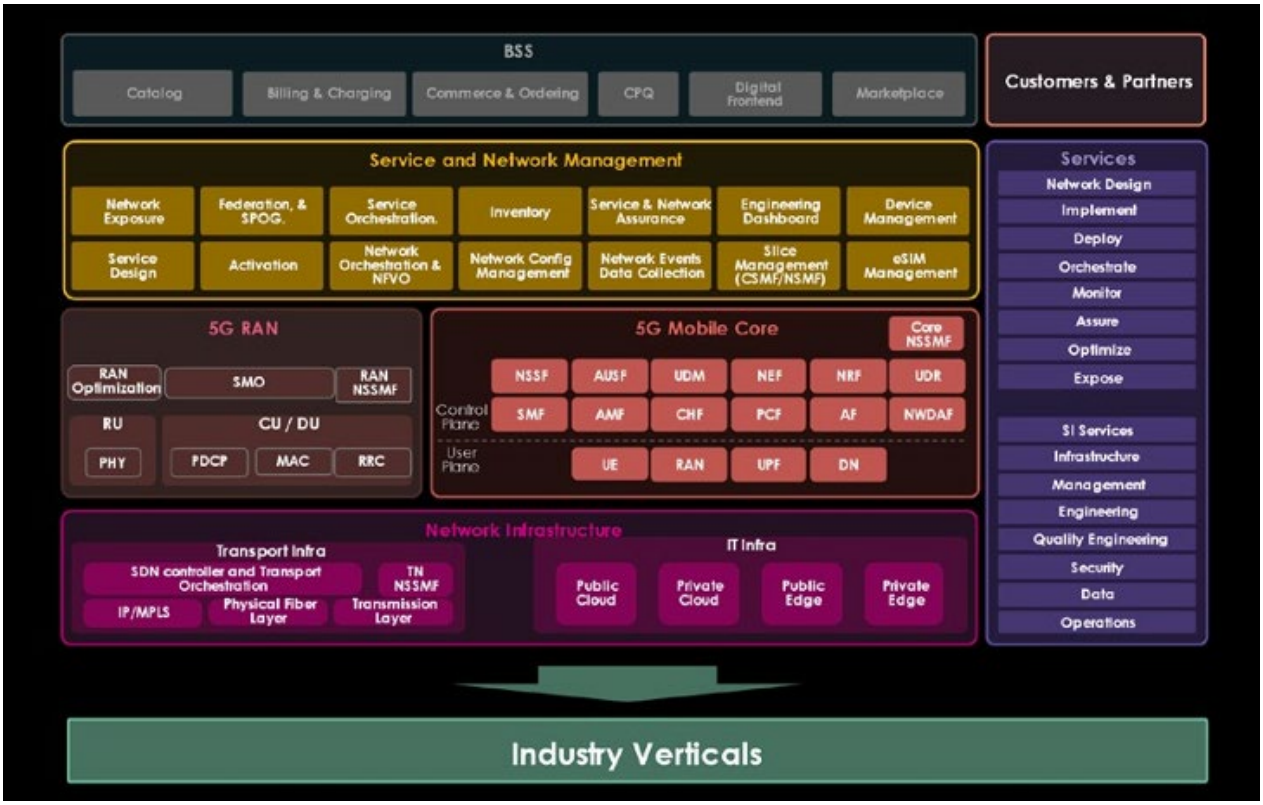


Source: TÉRAL RESEARCH

AMDOCS HAS BEEN LEADING THE BSS MARKET FOR MORE THAN A DECADE

And when it comes to 5G, the Israeli company comes from the monetization angle, which means 5G monetization through network slicing and charging: in January 2018, Amdocs announced the world's first 5G-ready online charging platform. Amdocs' approach is to focus on prioritized value-oriented areas of 5G and network co-ordination capabilities, based on its expertise and experience in policy, charging, exposure and data management.

Figure 24: Amdocs' 5G Core



Source: Amdocs

The combined 5G core together with Microsoft is further benefited by Amdocs' well established, advanced orchestration, managed services, systems integration, design and delivery capabilities to offer a full turnkey, de-risked and efficient solution. Through its understanding of current market challenges and pressures on revenues, EBITA and the economics of the industry, Amdocs offers innovative commercial models including as-a-service and pay-as-you-grow.

Stéphane Téral — Founder & Chief Analyst
Stelyana Baleva — Director of Research & Principal Analyst

THANK YOU

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