

## Radisys\* 5G Connect Open RAN adds Intel® Edge Software for Private 5G

**Radisys\* 5G Connect Open RAN and 5G Core cloud native software with Intel® Smart Edge Open Private Wireless Experience Kit create easy-to-deploy, high performance, resilient, turnkey solution for private 5G networks.**



Companies face many challenges as they map their enterprise networks to their changing business needs. The adoption of emerging technologies, such as the Internet of Things (IoT), cloud-native containerized network functions, and artificial intelligence, are increasing bandwidth requirements, adding more devices to the network and increasing mobility requirements.

This means rising demand for private 5G networks, also called non-public networks (NPN) in the 3GPP Release 16 standard. These private networks provide connectivity to all devices, but are most beneficial for factory floors where low latency is needed, or IoT applications where massive connectivity is required to support a large number of IoT sensors.

With a 5G NPN, organizations gain more control over data access, have enhanced data integrity, boost service levels, gain more configuration flexibility, improve performance, and simplify upgrades. In addition, traffic generated within a private network is processed locally, meeting government mandates, improving security and data privacy, and reducing latency.

The NPN standard covers private networks that are deployed either as standalone networks operated independently using the organization's own licensed wireless spectrum and avoiding reliance on traditional national mobile network operators. A NPN can also be operated as a public network-integrated NPN (PNI-NPN), which is still a private network but is supported by the spectrum and infrastructure of a national service provider. With a PNI-NPN, the organization takes advantage of operation automation such as artificial intelligence self-healing and automated fault recovery. They also scale-out resources while significantly reducing the operational burden via other automated routines. Companies gain needed coverage, capacity, and handover functionality so data reliability increases. The new infrastructure also is capable of integrating and working with other public and private 5G networks to improve communications and ensure service continuity.

Open virtualized radio access networks (Open vRAN) are an important enabler of 5G NPN. The software runs on commodity server hardware (COTS) and is virtualized using either network functions virtualization (NFV) or cloud-native containers. Adopting Open vRAN results in more scalable, less costly, and more efficient network deployments. In addition, networks take advantage of artificial intelligence and machine learning to automate operational network configuration and management functions, which traditionally required a great deal of manual input. Also, customers are no longer locked into network hardware vendors' proprietary solutions and can deploy more cost effective, intelligent multivendor solutions.

5G NPNs are often deployed on a customer premises to ensure the best latency and device coverage, and the solutions must be virtualized in order to scale to support user demand. Edge computing is also an emerging technology designed to bring compute functionality close to where data is created. In essence, each edge node can host cloud-native, container-based network functions together with edge services, becoming an edge cloud server that provides the same compute function without the transport time associated with using a centralized data center.

Building edge solutions can be challenging because they include many components that need to be integrated. To help organizations deliver 5G edge Private 5G Networks, Radisys, an Intel® Network Builders ecosystem collaborator, has developed an integrated solution that combines its 5G network technology with the Intel® Smart Edge Open-based Private Wireless Experience Kit (PWEK) to simplify edge deployment and enable co-existence of edge services and network functions on the same edge nodes.

### Radisys Connect Open Radio Access Network

The Radisys Connect Open RAN solution is an intelligent, virtualized network platform offering enterprises needed flexibility. The product disaggregates hardware from software and relies on standard Intel® architecture processors and open interfaces.

O-RAN is based on standards developed by the O-RAN Alliance, a global consortium founded in 2018 by network operators. The specification addressed the shortcomings found with legacy RAN architectures, which are based on the distributed radio access network (D-RAN) model. Here, baseband units (BBUs) and remote radio heads (RRHs) relied

on proprietary compute and software solutions co-located at a cell site. Their centralized RAN and BBU pool did not scale cost-effectively and could not support the capacity and performance requirements of 5G networks, incurring high operating expenses and underutilizing RAN resources.

Radisys' Private Networks product is based on its RAN and Core Network protocol software that features support for both LTE and 5G networks and can operate in non-standalone (NSA) or standalone (SA) modes. The solution supports sub 6 GHz (frequency range 1 or FR1) and millimeter wave (FR2) licensed spectrum, and also works with the citizens broadband radio service (CBRS), a new 150MHz frequency range in the 3.5GHz band that is set aside for private 5G applications.

The software supports self-organizing network (SON) and automatic neighbor relations (ANR) features to adjust signal strength and minimize coverage overlaps between small cells.

The solution can be integrated with operations administration and maintenance (OAM) / element management systems (EMS) through its support of NETCONF YANG and TR069. Its standardized management interfaces for FCAPS and data models per 3GPP and O-RAN provide easy integration with EMS and network management systems.

With full support for disaggregation, Radisys Connect Open RAN solution provides complete control/user plane separation, integration through open interfaces with RAN Intelligent controllers (RICs), and application of AI/ML through various xApps. The high-performance, feature-rich software package is fully interoperable for multi-vendor Open RAN deployments.

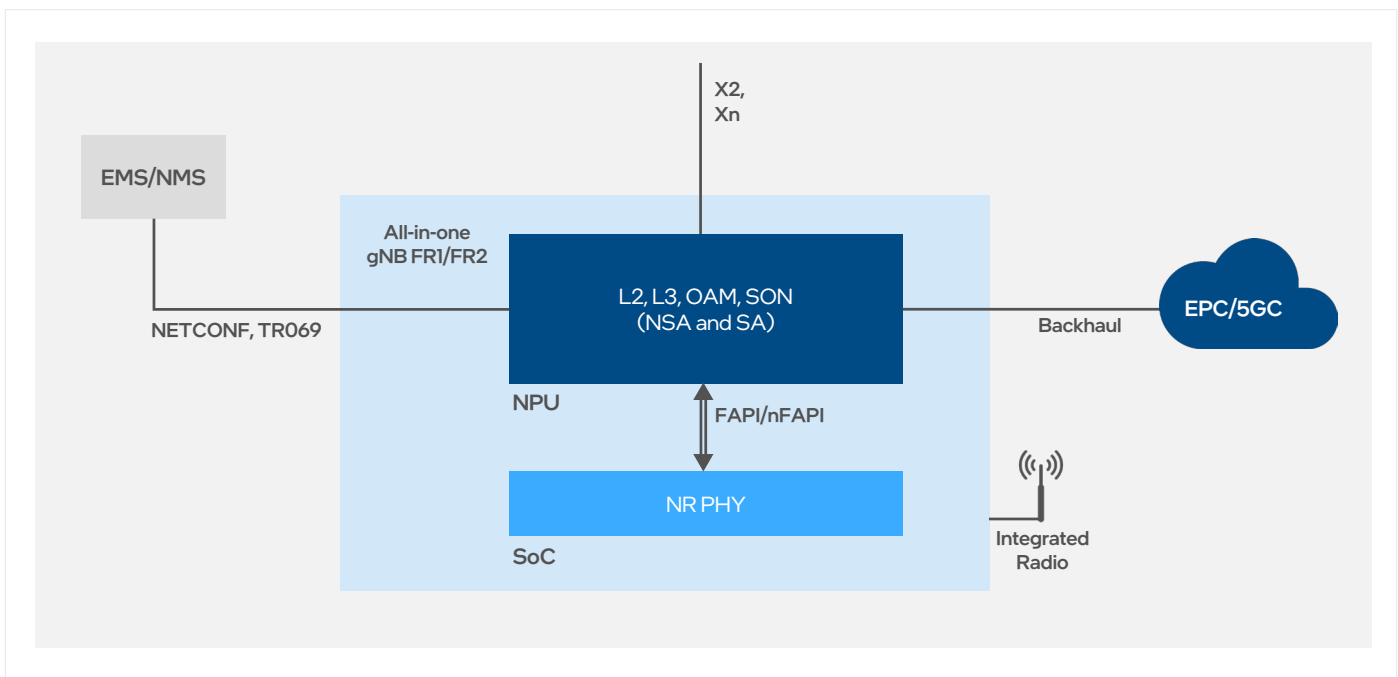


Figure 1. 5G base station with Radisys Open RAN and 5G Core software (in dark blue).

For performance, the software runs on servers utilizing 3rd generation Intel® Xeon® Scalable processors. These latest-generation CPUs are built for cloud-optimized edge 5G and next-generation virtual networks; and they deliver edge application, service, and control plane processing, high-performance packet processing and signal processing. Network-optimized 3rd Gen Intel Xeon Scalable processors (N SKUs) are designed to support diverse network environments. Optimized for many workloads and performance levels, they are available with a wide range of cores, frequencies, features, and power. For organizations ready to drive 5G networking to the next level, these CPUs increase 5G user plane function (UPF) performance dramatically.

Other Intel hardware accelerators can optionally be used in the system including the Intel® vRAN Accelerator ACC100, which accelerates processing of L1 forward error correction (FEC) data. The FlexRAN™ reference architecture was utilized to provide the layer 1 processing functionality for the PWEK.

### Intel® Smart Edge Open

To help build the solution at the edge, Radisys has adopted Intel software that facilitates building complete private 5G edge deployment. The core of this software is Intel® Smart Edge Open, a Cloud Native Computing Foundation-certified software framework for building edge solutions. The solution accelerates development and deployment of highly optimized,

secure and scalable edge platforms, services & solutions. It enables reference blueprints called Experience Kits that are optimized for common use cases powered by a certified Kubernetes cloud native stack.

For private 5G deployment, the Intel® Smart Edge Open Private Wireless Experience Kit (PWEK) accelerates on-premises 5G deployments with reference blueprints enabling converged 5G network functions and edge services. Figure 2 shows an overview of all software (currently supporting CentOS with future releases supporting Ubuntu) and hardware components of PWEK.

The PWEK combined with Radisys 5G software offers a complete solution for Private 5G with edge services on a single edge node. Customers can use this solution architecture as a whole or in a modular way to build a private 5G network. PWEK simplifies the onboarding and management of Radisys RAN and 5G Core container network functions (CNFs).

The product accelerates time to market and reduces cost and performance risks associated with developing cloud-native networking platforms by using a reference blueprint optimized for Intel® hardware. The solution abstracts the underlying network infrastructure complexity, and supports common use cases and works well with compute-intensive edge workloads, like 5G co-existing with AI and media edge services workloads.

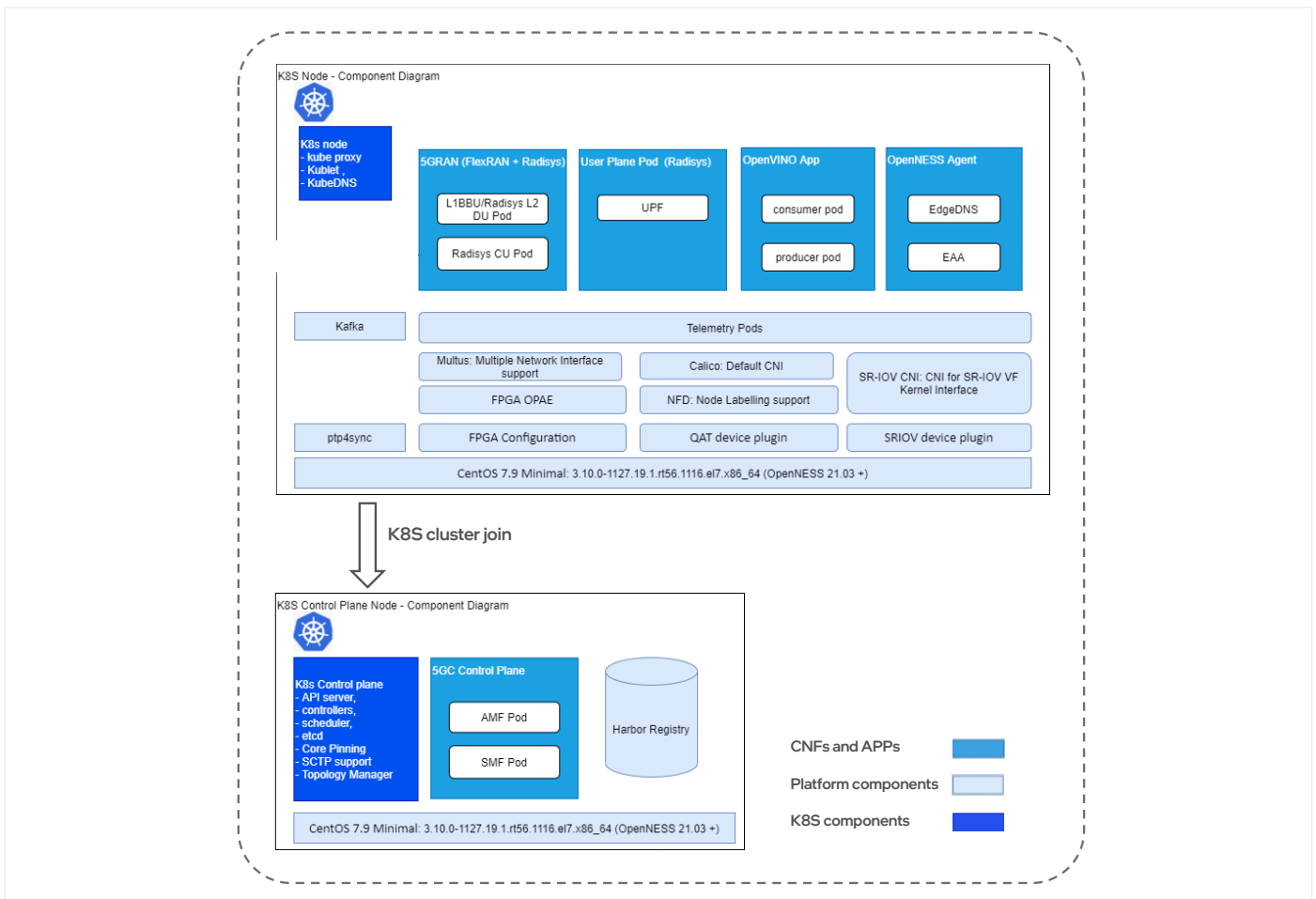


Figure 2. PWEK component diagram.

## Creating the Solution

The Radisys solution based on Intel technology improves building a private 5G network in many ways. The Intel Smart Edge Open PWEK delivers a Kubernetes cloud native framework optimized for Intel architecture and streamlines on-boarding, so companies can adapt their edge network configurations on the fly. As a result, the orchestration of network services becomes simpler and able to accommodate unexpected changes to network requirements.

The solution provides flexibility and extendibility. The PWEK complies to 3GPP standards and follows the Open RAN standards helping Radisys to easily integrate its standards-based RAN and core solutions.

Customers that run Radisys Virtual RAN (vRAN) workloads require networks with determinism and very low latency guarantees. Intel Smart Edge Open provides acceleration to vRAN workloads through easy access to accelerators.

Throughput is an important consideration as workloads become larger and more complex. Radisys RAN and core workloads leverage the Intel Smart Edge Open for performance optimized I/O and high-speed data plane. This eases access to Intel NIC cards with SR-IOV features that enable direct network connections from a CNF to a NIC. Intel Smart Edge Open can also support Intel Quick Assist Technology (Intel® QAT) acceleration for IPsec workloads.

Radisys Private Networks solution needs the right platform resources at all times. Intel Smart Edge Open's resources management capabilities include:

- Discovery of platform resources (through Node Feature Discovery) prior to on boarding each RAN and core workload
- CPU core allocation to the network functions to deliver the right amount of processing power
- Awareness of memory and I/O collocation so the RAN and core workloads will be on-boarded on sockets having sufficient memory and NICs to reduce latency

Radisys Private 5G workloads require continuous monitoring of the health of the platforms, network load, and resources. Intel Smart Edge Open offers telemetry capabilities during runtime so customers have information about the platform resources consumption (CPU, memory, I/O, power consumption). That data enables them to determine if they have to add resources to the RAN/core workload. With the information, corporations are able to scale RAN/core workloads, accommodate more connections, and migrate RAN/core CNFs to other platforms

The Radisys Connect Open RAN software is tested for interoperability with many partners and third-party network solutions. It works with multiple PHY/radio, various core network implementations, commercial handsets, and UE test equipment.

## Conclusion

Providing a complete 5G private network solution requires both high-performance 5G protocols with an edge server infrastructure platform that creates the virtualization and automation layers. By combining Radisys Connect Open RAN and core software with Intel Smart Edge Open PWEK, network builders can deploy a network without the complexity that can come with an edge deployment. This combined Intel and Radisys solution delivers leading edge functionality, boosts performance, streamlines deployment, and lowers costs, empowering enterprises as they migrate to private 5G networks.

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