Solution Brief

System Integrators, Enterprises, Telecom Service Providers
Smart Training, 3D Virtualization Streaming, AI Monitoring Surveillance, Smart Manufacturing

HTC Group/G REIGNS and Intel Collaborate on Portable Private 5G Networks

The REIGN CORE S2 solution ramps in 30 minutes with key benefits for AR/VR

The virtualization of 5G networking equipment, availability of open interfaces, and access to a dedicated private 5G spectrum are driving interest among a wide range of enterprises in building private 5G networks. Industry analyst firm Omdia predicts that by 2027, private LTE and 5G networks combined will have a total market size of $7.4 billion - and private 5G will account for 92% of that[1].

Because the 5G packet core and radio access network (RAN) software runs on Intel® architecture servers, the cost of building the network, compared to hardware-based legacy systems, has come down and many IT departments have the technology expertise needed to manage these networks. With expanded connectivity, high bandwidth, and very low latency, private 5G networks are better suited for systems needing real-time data access (such as robotics or augmented reality/virtual reality) or mobility (autonomous vehicles).

Some of the initial markets for private 5G networks include manufacturing, smart cities, utilities, education, healthcare, stadiums and entertainment, retail, mining, oil and gas, and others. Beyond these, the performance advantages of private 5G bring new applications where the network needs to be portable for onsite training, design collaboration, machine digital twins, automated optical inspection use cases, and more.

G REIGNS is an HTC Group subsidiary and an Intel® Network Builders ecosystem member. The company has developed baseband unit (BBU) software for a portable private 5G system. It has also worked with its ecosystem of partners to deliver a complete, vertically integrated portable system based on an Intel architecture processor-based server. This server also uses Intel FlexRAN™ reference architecture and other Intel technologies.

REIGN CORE S2 Offers Self-Contained Private 5G

The REIGN CORE S2 is a complete and self-contained private 5G network with a 5G core and baseband unit (BBU), which is the foundation of the radio access network (RAN), all based on a server powered by 3rd Gen Intel® Xeon® Scalable processors.

The system comes in its own portable case and can be set up in around 30 minutes. In the default configuration, the REIGN CORE S2 features open RAN structures including 5G core based on Druid Software's Raemis™ combined with the internally developed baseband unit for RAN processing.

Druid Raemis™ is a set of cellular software assets optimized for business use cases. G REIGN's BBU provides centralized unit (CU) and distributed unit (DU) functionality to convert analog wireless signals into digital packets for processing by the 5G core. Both network elements run in containers on an Intel-based server and are 3GPP and O-RAN Alliance compliant.

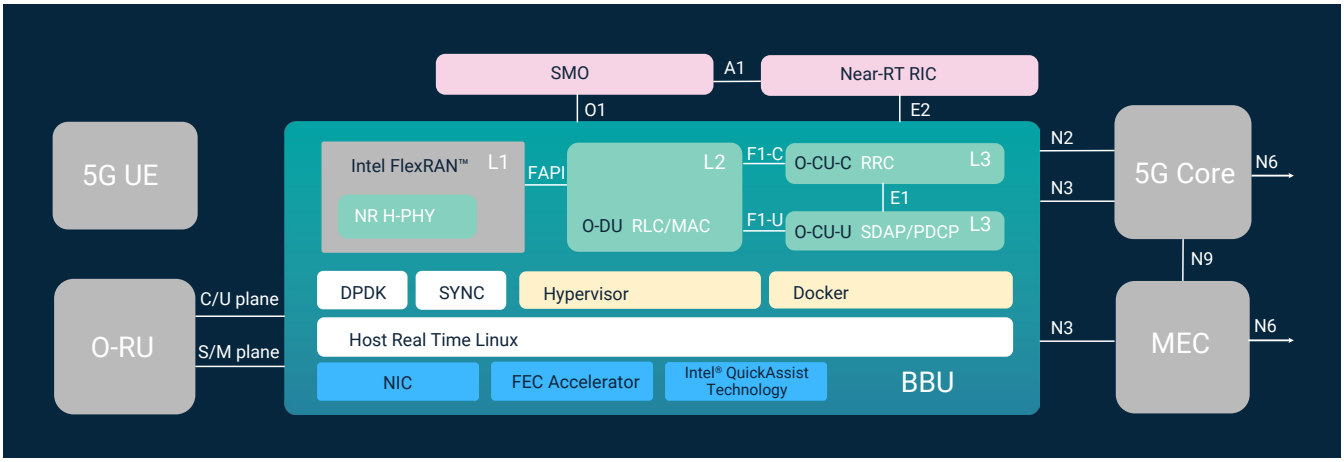

Figure 1. Block diagram of REIGN CORE S2 portable private 5G network system.

The system is compatible with 5G core software from other vendors that meets 3GPP and O-RAN Alliance standards for functionality and open interfaces. A wide range of standards-based remote radio units (RRUs) are also supported by the system.

The REIGN CORE S2 supports advanced Open RAN management technologies (see Figure 1) such as near real time (near-RT) RAN intelligent controller (RIC), which uses xApps from G REIGN or third parties to offer additional functionality and edge control of the RAN nodes. The REIGN CORE S2 also features service management and orchestration (SMO) functionality that delivers intelligent automation to manage network performance.

The REIGN CORE S2 is a vertically integrated solution with the ability to support the software needed for applications and has been specially optimized for AR/VR applications which require high throughput, low latency, and strict connection reliability. For example, later in this document are AR/VR use cases for a theater immersive experience as well as immersive training for law enforcement and first responders. The application software and content for that use case can be run on unused cores in the server or run on an industrial PC that is connected to the server.

Up to two RRUs can be connected to the REIGN CORE S2 at the same time. The system is designed to be easily deployable in a private 5G deployment environment where space is at a premium.

The full specifications for the product are in Figure 2, with the highlights including a capacity of 30 active user equipment (UE) devices and 100 MHz of bandwidth for up to 1 Gbps in downlink or 350 Mbps in uplink throughput.

Product Description	
Max. UE	Max. 30 Active / Default 20 Active
Cell Power	250mW Indoor (Outdoor 5W is ready as Option)
Ant. MIMO	Cell-free 8T8R, DL 4 Layers, UL 2 Layers
Bandwidth	100MHz
Band	FR1: n77, n78, n79, n48
Time Sync.	GPS Free
OAM	Web UI Interface
Latency	Avg. 20~30 ms
Coverage	10,000 m^2
Profile	Default DL 800Mbps / UL 120Mbps
Dimension	D610mm x W575mm x H155mm

Figure 2. REIGN CORE S2 specifications.

REIGN CORE S2 used in Cutting-Edge AR/VR Use Cases

Augmented reality / virtual reality (AR/VR) use cases benefit from the performance and portable nature of G REIGNS private 5G networks.

One of the most innovative use cases is "Le Bal de Paris de Blanca Li," an immersive AR/VR theater experience. In the show, 10 attendees at a time are strapped into private 5G-connected AR/VR, then pick their virtual tuxedos and ball gowns in order to become guests of a virtual ball and interact with the performers/dancers who are the heroes of the show.

The show won Best VR Experience at the Venice Film Festival in 2021, and the novelty of the AR / VR show has one reviewer calling "Le Bal de Paris de Blanca Li" the "coolest experience around."

G REIGNS also teamed up with AR/VR solution integrator V-Armed for an AR/VR training application. V-Armed is a New York-based virtual reality technology company specializing in immersive training for law enforcement and first responders. V-Armed worked with a government agency in Belgium to bring up a 5G private network for training it was conducting using AR/VR.

The training was situational and tested responses to real-life scenarios. The V-Armed AR/VR solution immersed the trainees in an environment that simulated real-world experiences and enabled the training to take place safely and cost-effectively. It also provided post-training feedback sessions that replayed the AR/VR simulation for group learning and discussion.

Any latency or lag in the network could impact the response of the trainees. Thus, the network must deliver low latency, and high throughput coverage for the 10,000 square meter training space. The system ran on frequency band N77 which is set aside for private 5G networks in Belgium.

The simulation used VIVE XR Elite all-in-one XR headsets from VIVE, a subsidiary of HTC Corp. The VIVE XR Elite features a 3840 x 1920 resolution with a 110-degree field of view with a 90 Hz refresh rate. Each sensor was fitted with a 5G router for connecting to the network.

OptiTrack Prime^X cameras were used as sensors and were placed throughout the training facility to record the movements and location of the trainees. An assortment of hand-carried training gear was also part of the simulation and was connected to the network to track usage and movements.

The network was optimized for throughput supporting 10 concurrent users. For this application, a server (Supermicro SuperServer SYS-110P-FWTR) based on 3rd Gen Intel Xeon Scalable processors processed the 5G core and BBU workloads. A dedicated Intel® vRAN Accelerator ACC100 Adapter card was added to the server to perform forward error correction (FEC). Intel® Ethernet Network Adapter E810-XXVDA4T delivered high-precision timing connectivity. Two radio units, powered by Intel® Arria® 10 SX 480 FPGA graphics processor units (GPU), provided the radio coverage.

More details on the Intel technologies used in this demo:

The Intel® Xeon® Scalable processors

The G REIGNS servers for the solution are based on Intel Xeon Scalable processors. These processors are the foundation for powerful servers that deliver compute agility and scalability. These CPUs benefit from decades of innovation for the most in-demand workload requirements and are part of a complete set of edge technology from Intel.

Intel Xeon Scalable processors feature a balanced architecture that supports Open RAN with built-in acceleration and hardware-based security features. Other features for modern 5G network workloads target low latency, high throughput, deterministic performance, and high performance per watt.

Intel® vRAN Accelerator ACC100 Adapter

RAN applications need added compute performance to help with processing forward error correction (FEC) workloads. FEC is a mechanism designed to resolve data transmission errors over unreliable or noisy communication channels. In the AR/VR network, G REIGNS utilized the Intel vRAN Accelerator ACC100 Adapter to handle these compute-intensive workloads boosting total system throughput in a significant way.

Intel® FlexRAN™ Reference Software

Intel has created FlexRAN reference software as a vRAN layer 1 reference implementation that is used by G REIGNS for PHY and MAC layer processing in the BBU. In this application, FlexRAN reference software efficiently implemented wireless access workloads powered by Intel Xeon Scalable processors. FlexRAN comprises several modular, virtualized control functions with well-defined interfaces that allow flexible and programmable control of the layer 1 wireless infrastructure.

Intel® Ethernet Network Adapter E810-XXVDA4T

This solution requires a network interface card with precision timing synchronization. REIGN CORE S2 selected the Intel Ethernet Network Adapter E810-XXVDA4T with support for both IEEE 1588 Precision Time Protocol (PTP) and Synchronous Ethernet (SyncE) methods. The E810-XXVDA4T's onboard high-precision oscillator maintains accuracy when the synchronization source is not available, providing up to four hours with less than +/- 1.5 microsecond of phase error.

Conclusion

Private 5G technology is ideal for a wide range of enterprise use cases including a growing number of applications requiring portable networks. G REIGNS has recognized these applications and developed the REIGN CORE S2 complete private 5G network system that can be set up in about 30 minutes and offers a complete standards-compliant network with up to 1 Gbps in downlink or 350 Mbps in uplink throughput. The system combines G REIGN's proven BBU along with Druid Raemis 5G core software or other 5G core software from G REIGN's ecosystem of partners. A successful AR/VR stage show and first-responder training with a Belgian government agency demonstrated the value of this system by delivering flawless and high throughput for these very latency sensitive applications.

Learn More

G REIGNS website

Druid Software Raemis platform

Intel® Xeon® Scalable processors

Intel® Network Builders

V-Armed

Intel® Ethernet Network Adapter E810-XXVDA4T

[1] https://www.networkworld.com/article/1248627/8-top-industries-for-private-5g.html

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