SOLUTION BRIEF

SUPERMICRO ENABLES PRIVATE 5G WITH ZERO-TRUST PROTECTION

Secured 5G Enterprise Network for Commercial Deployment

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Executive Summary

With the three main use cases, eMBB, URLLC, and mMTC, 5G changes the way of network deployment not only in telecom operators but also in enterprises. In recent years, private 5G is gradually turning to commercial deployment from proof of concept (POC) since performance is no longer the key issue.

Network security threat is becoming the next critical challenge in a commercial network. Open RAN using a COTS server as its infrastructure, the same as other IT networks. The malicious actor may gain access to your network and damage it, exposing your organization to a data breach.

For different capability and use case requirements in large enterprise 5G network, two typical configurations of Supermicro Secured 5G Enterprise Network, designed for commercial deployment, have been validated and bundled with ecosystem partners' technologies.

5G BBU Of High Flexibility and Reliability

The Base Band Unit (BBU) is the most essential element of a private 5G network. However, in the Open RAN architecture, the BBU is compromised by the Distributed Unit (DU) and the Centralized Unit (CU), which is deployed on top of the standard X86 COTS server.

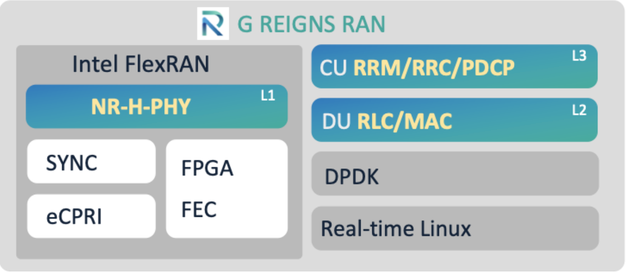

Figure 1. *HTC RAN Architecture*

Supermicro is collaborating with HTC, a professional RAN software solution supplier for the private 5G, to deploy HTC RAN on Edge Server SYS-110P-FWTR and SYS-220HE-FTRN, consisting of CU, DU, and FlexRAN (L1) specialized in UL Centric, DL Centric, and VR Traffic.

RAN-CU comprises Layer 3, RRM, CU-OAM, and PDCP/GTPu software. The RAN-DU includes the MAC, RLC, F1-U, DU Manager, and DU-OAM software. The interface between RAN and RU is O-RAN compliant option 7.2x split (eCPRI), which is comprised of FlexRAN (L1) utilizing the Forward Error Correction (FEC) Hardware Accelerator.

Benefits from Supermicro Edger Server:
- Building Blocks Open hardware allows rapid, flexible deployment and cost-effective upgrade
- Ready for edge AI inferencing for real-time, real-life services
- Ready for streaming video content localized and optimized at the Edge
- Rich I/O ports on board, reducing spending on addon NIC and saving PCIe slots

Entry Level Solution – Supermicro SYS-110P-FWTR
Key Performance Reference:[1]

- Network Mode: NR SA, Rel 15
- UE Number: Max. 32 active / Default 20 active
- Bandwidth: 100MHz
- Latency: Avg. 20~30 ms
- Profile: DL 700Mbps / UL 120Mbps (Default Profile)

Figure 2 - Supermicro SYS-110P-FWTR

SYS-110P-FWTR, a short-depth 1U rackmount server (NEBS Level3 certification optional) optimized for edge computing applications, supporting 3rd Gen Intel® Xeon® Scalable processors, supporting a maximum of three PCIe Gen4 x16 slots and an additional 2x 10GbE Base-T ports on board.

To meet the low latency requirement between RU and DU, the Intel® vRAN eASIC Accelerator ACC100 plays a crucial role in 5G LDPC FEC processing, saves the total system power consumption, reduces CPU core count requirements, and increases in cell capacity than FPGA accelerator.

TPM 2.0 hardware-based security on the motherboard ensures that the encryption keys, passwords, and digital certificates are more secure from external software attacks and physical theft.

High Performance Solution – SYS-220HE-FTNR
Key Performance Reference:[2]

- Network Mode: NR SA, Rel 15
- Max. UE per Cell: Max. 256 connected / 128 active
- Bandwidth: Up to 100MHz
- Latency: Avg. 20~30 ms
- Throughput: Max. DL 1Gbps, Max. UL 350Mbps

Figure 3 - Supermicro SYS-220HE-FTNR

The Supermicro Hyper-E Configurable Edge Server is designed exclusively to provide flagship performance with maximum configurability for the most demanding 5G, Telco, and Edge environments, in a dense, short depth, front I/O, 2U form factor and has the option available of NEBS Level 3 Certification. The dual CPU architecture allows for a powerful computing capability, suitable for the heavy workload scenario such as 5G DU/CU plus edge computing.

Hyper-E server provides flexible network options with 2 AIOM networking slots (OCP NIC 3.0 compatible) with 4 x 25GbE SFP28[3] ports, which meets the most networking requirements in mass deployment of private 5G. In addition, up to 8 PCIe slots[4] greatly enhance the expansion capability in networking and GPU, making it possible to put the 5G base station and the MEC (Multi-Access Edge Computing) in a single server.

Zero-Trust 5G Core Of Rich Functionality and Top Security

5G Core Developed for Private 5G

In addition to the BBU, the 5G Core (5GC) network is the brain of the private 5G network and realizes the full potential of 5G services. Supermicro works with Saviah on the Core side, who has a highly experienced professional team, having made further improvements and enhancements over and beyond free5GC and accomplished a robust, commercially launched 5GC network software.

The Core of the Supermicro Secured 5G Enterprise Network complies with 3GPP R15/R16 standards and has complete Network Functions (NFs), as shown in the figure below:

The benefit of Saviah 5GC:

- Open interfaces
- Integrate off-the-shelf hardware
- Fit RAN/Open RAN
- Agile customization
- Cost-effective
- Collaborate multi-vendors

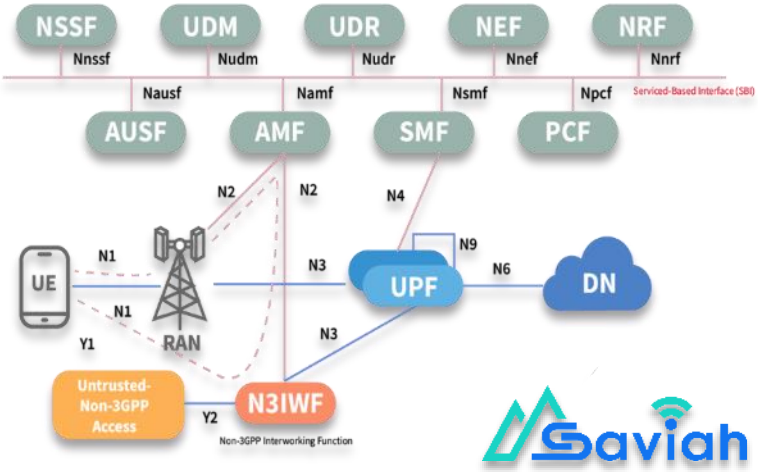

Figure 4 – Saviah 5G Core Architecture

Reliability:

Saviah 5GC guarantee **5x24*** hours operation continuously.

Flexibility:

Saviah 5GC is very flexible in terms of hardware and software integration and can be deployed **On-Premises** or in the **Cloud**.

Capacity:

Control plane:
50* user registration per second
20,000* UE registered
1,000* gNB connection
User plane:
30* Gbps data throughput (with DPDK 40G NIC)

*Test by Spirent Landslide

Zero-Trust Solution Cares the Security

To ensure ultra-low latency communication, the compute capability gets denser and closer to the edge, involving much more intelligent devices and data packages on the edge side than before. It makes the 5G network a bigger attack surface and a steeper training curve than 4G. Besides, new technologies like network slicing and virtualization also introduce new risks. Supermicro needs to find an intelligent and effective way, with our cybersecurity solution partner Zscaler, to protect all the nodes of the Private 5G network from attack.

In May 2021, President Joe Biden signed the 30-pages Executive Order[5] on Improving the Nation's Cybersecurity, setting forth a Federal zero-trust architecture strategy. The National Institute of Standards and Technology (NIST) also publishes a guidance[6] on Zero Trust Architecture.

The mission of Zero-Trust is to make sure that every data packet on every network is "verified and escorted" from source to destination. A Zero-Trust approach includes:
- Assumes that a breach is inevitable or has already occurred
- Constantly limits access to only what is needed
- Looks for anomalous and/or malicious activity everywhere

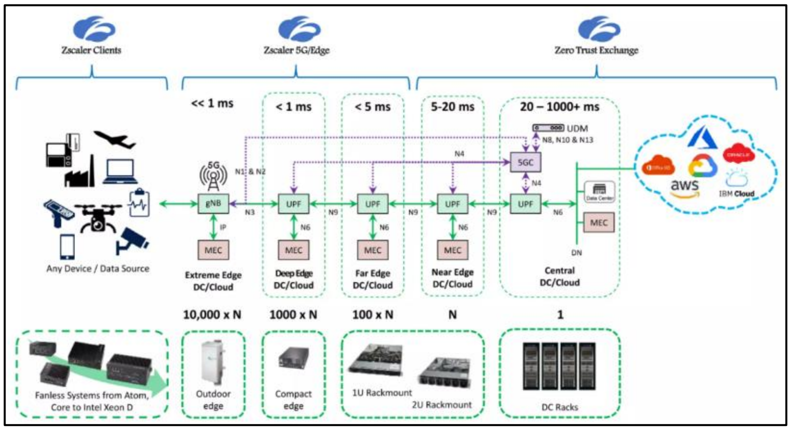

Figure 5 - Zero-Trust from the Edge to the Core

Supermicro's Secured 5G Enterprise Network is deeply integrated with Zscaler's Zero-Trust security platform on both software and hardware, applies Zero-Trust from the Central DC/Cloud to each level of edge nodes till the terminal devices/Data Sources, ensure the safety of the complete data chain, and delivers exceptional user experience, reliability, and security. Specifically, we apply the policies in 5 ways:

- Only authorized and identified users with validated devices are allowed access
- Workloads must be isolated and only accessed if allowed by policy
- Networks are a security control - they are used only for transport, not control
- Processes are isolated and authorized only to speak to allowed processes
- Monitor and report all connections end-to-end

Application Operation Management for Total Solution Integration

For cost-effective total solution deployment at scale, the most troublesome issue is the integration of the whole network and the applications, such as devices and sensors for smart manufacturing, smart traffic, and AI for video surveillance, etc. it is essential to achieve a one-stop operation management system on top of all these network elements. Therefore, Supermicro has worked with our ecosystem partners to implement a new application operations management (AOM) system SuperMEC.

Key Benefits of SuperMEC:

- A single-pane-of-glass platform with a streamlined, intuitive management interface
- A standardized Redfish Northbound API Message Bus for easy third-party software platform integration
- A scalable management platform without adding unnecessary complexity
- A unified dashboard that encompasses compute, storage, networking, rack, base station, and 4G/5G core management
- The ability to monitor and manage all elements of the resource pools in a Composable Disaggregated Infrastructure (CDI)
- Open distributed infrastructure management & deployment framework, scalable containers base platform
- Role-based access control to support modern data center security policies and zero trust architecture.
- Rich analytics, telemetry, provision, and intelligent system lifecycle management
- Parallel multi-system upgrade and configuration capability reducing hardware maintenance downtime
- Topology views show the physical and logical graph of the network structure, networking relationship, and connection status
- Infrastructure as a Service, Vertical SaaS, and Monitor as a Service are essential to smart manufacturing, private networks, telco cloud, retail, telemedicine, and smart city use cases.

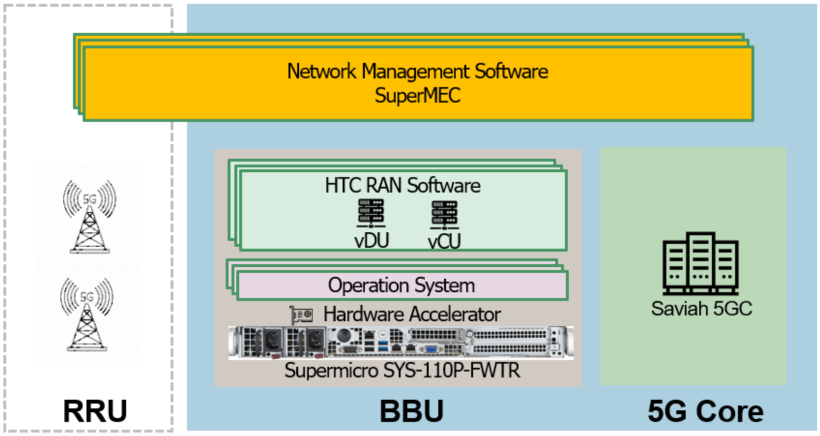

Figure 6 - Supermicro Secured 5G Enterprise Network Architecture

Conclusion

Private 5G is a multi-vendor network. It breakthroughs the vendor lock to ensure the best cost-effectiveness. But on the other hand, it increases the complexity of integration between each network element and the cybersecurity system. Supermicro, HTC, Saviah, and Zscaler are working together to validate a new generation Secured 5G Enterprise Network, providing data-sensitive enterprises and governmental entities a flat path to own their 5G network with deeply integrated Zero-Trust cybersecurity protection.

About HTC

REIGN Technology Corporation (G REIGNS), a subsidiary of HTC Group, provides a 5G RAN solution that complies with O-RAN open interfaces and supports cloud-native vRAN. We focus on baseband unit software development and optimization. Instead of a general purpose 5G network, G REIGNS is dedicated to customizing our 5G network solution to fulfill enterprise use case requirements and beyond customers' expectations.

About Saviah

Saviah Technologies, Inc. was founded by Professor Jyh-Cheng Chen of National Yang Ming Chiao Tung University (NYCU), who, with his team, developed free5GC—the world's first open-source 5G core (5GC) network that complies with 3GPP R15 standards.

About Zscaler

Zscaler, Inc. operates as a cloud security company worldwide. It offers Zscaler Internet Access solution that provides users, workloads, IoT, and OT devices secure access to externally managed applications, including software-as-a-service (SaaS) applications and internet destinations; and Zscaler Private Access solution, which is designed to provide access to managed applications hosted internally in data centers, and private or public clouds. Zscaler, Inc. was incorporated in 2007 and is headquartered in San Jose, California.

Notes:
1. The performance indicators are only for reference. The numbers may change when using different Radio Unit(s), user devices, and in different electromagnetic environments.
2. The performance indicators are only for reference. The numbers may change when using different Radio Unit(s), user devices, and in different electromagnetic environments.
3. Optional 8 x 1Gb RJ45 ports is also available.
4. The PCIe Gen4 slots quantity may vary according to configuration.
5. Reference: https://www.whitehouse.gov/wp-content/uploads/2022/01/M-22-09.pdf
6. Reference: https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-207.pdf

Case Study: Compact Integrated Setting

- A portable 5G private network system puts all necessary network components in a compact rack such as a suitcase.
- Other than Supermicro's servers installed with Saviah 5G core software and a L3 switch, the system includes a BBU and RRU equipped with HTC RAN software.
- This "ready-to-go" system, in complaint with 3GPP and O-RAN architecture, supports users to setup a 5G network easily and rapidly with predictable performances.

Solution Description	
Max. UE	32 Connected / 16 active
Cell Power	250mW
Ant. MIMO	4T4R, DL 4 Layers, UL 2 Layers
Bandwidth	100MHz
Band	FR1 (n41, n48, n78, n79)
Latency	Avg. 20~30 ms
Profile	Default Profile (DL 700Mbps / UL 80Mbps)
OAM	5GC monitor Start/Stop Network Shutdown 5GC/RAN Profile switch SW/Profile update
Dimension	515mm * 430mm * 670mm