Solution Brief

Service providers and Infrastructure decision makers
Enterprise, Industrial, IoT, Private 5G network

NEXCOM's Private 5G uCPE Leverages Intel Atom® P5300 Processors

NEXCOM's FTA 1170 switch-server uses Intel Atom® P5300 for the power-efficient compute and integrated networking needed for private 5G applications; switch-server can also be used for multi-access edge (MEC) use cases.

The idea of using private 5G networks for enterprise and manufacturing applications is becoming increasingly popular, with 90% of executives anticipating that these systems will become the standard network choice, according to a survey by Economist Impact[1].

These executives, bolstered by the impacts of work-from-home and enhanced safety measures, are embracing private 5G's benefits including increased speed and connectivity, low latency, enhanced control and security and availability where public telecom infrastructure does not exist or is not feasible.

In fact, the survey also revealed that 51% of CIOs in UK, US, Japan, and Germany plan to deploy a private 5G network in the next two years, and that 24% have already done so. Businesses looking into private 5G already have strong use cases to consider in terms of the network's application in areas like industrial internet of things (IIoT), robotics, artificial intelligence (AI), and virtual reality and artificial reality. Some specific examples:

- Major automobile manufacturers have implemented private 5G in their manufacturing processes. These applications include a 5G-based digital automation cloud to increase efficiency at manufacturing sites, integrating IoT applications, digitalization and visualization, as well as systems for robotics control and data transmission.
- A multinational aircraft maintenance provider used private 5G to virtually inspect engine parts during the pandemic. Airports have also used private 5G to enable "Airport 4.0" technologies as a means for increased on-site digitalization and collaboration.
- Private 5G has also become common in supply chain applications, particularly at ports and transit hubs. Here, networks can boost safety, efficiency and collaboration and support digital twinning and virtual reality (VR) and augmented reality (AR) capabilities.
- Finally, private 5G has been used to support the healthcare sector where networks have enabled greater connectivity between devices and patient data, giving doctors faster access to data that help healing and recovery.

Private 5G remains a formative market, constantly adapting to availability of spectrum, global regulations and enterprise needs. Despite these challenges, however, the benefits of private 5G networks are becoming undeniable.

Building a Private 5G Network

Private 5G networks benefit from the work of telecom vendors to virtualize major 5G components disaggregating the software from the hardware, which introduces more competition into the market for better solutions at a lower cost. This virtualized software is designed to be run on commercial-off-the-shelf (COTS) server hardware platforms. Certain software functions can even be run in the cloud for additional cost savings.

Without this virtualization, the cost of monolithic systems would make private 5G available only to the largest companies.

Two network functions that have been virtualized are the open radio access network (Open vRAN) and the 5G core.

Open vRAN is one of the last cellular network functions to go virtual, because it demands very high compute performance. But successful deployments in public carrier networks using Intel architecture CPUs have made Open vRAN a popular choice in industrial settings worldwide.

The RAN consists of a baseband unit (BBU) that is located at every base station and remote radio heads (RRH). Open vRAN has disaggregated the BBU into two components: the distributed unit (DU), which processes RF signals at the physical layer in real time, and the centralized unit (CU), which processes layer 2 information in non-real-time. This functional separation provides significant network deployment flexibility because the CU can service multiple base stations.

Once packets are processed by the RAN, they then flow to the virtual 5G core for further processing that contributes to a secure and reliable connection as well as access to services and policies. As can be seen in Figure 1, the 5G core is connected to the vRAN and made up of seven different network functions that provide authentication, security, session management among other capabilities.

Both the Open vRAN and the 5G core need compute and connectivity which makes a switch-server an ideal solution. Switch-servers offer expanded packet processing capabilities that that can be used in data centers, at the network edge, in branch offices, or for edge network application such as those needed for 5G networks. These platforms are relatively new and are enabled by new processors such as the Intel Atom® P5300. NEXCOM, an Intel® Network Builders ecosystem partner, has chosen the processor for its FTA 1170 switch server for 5G deployments.

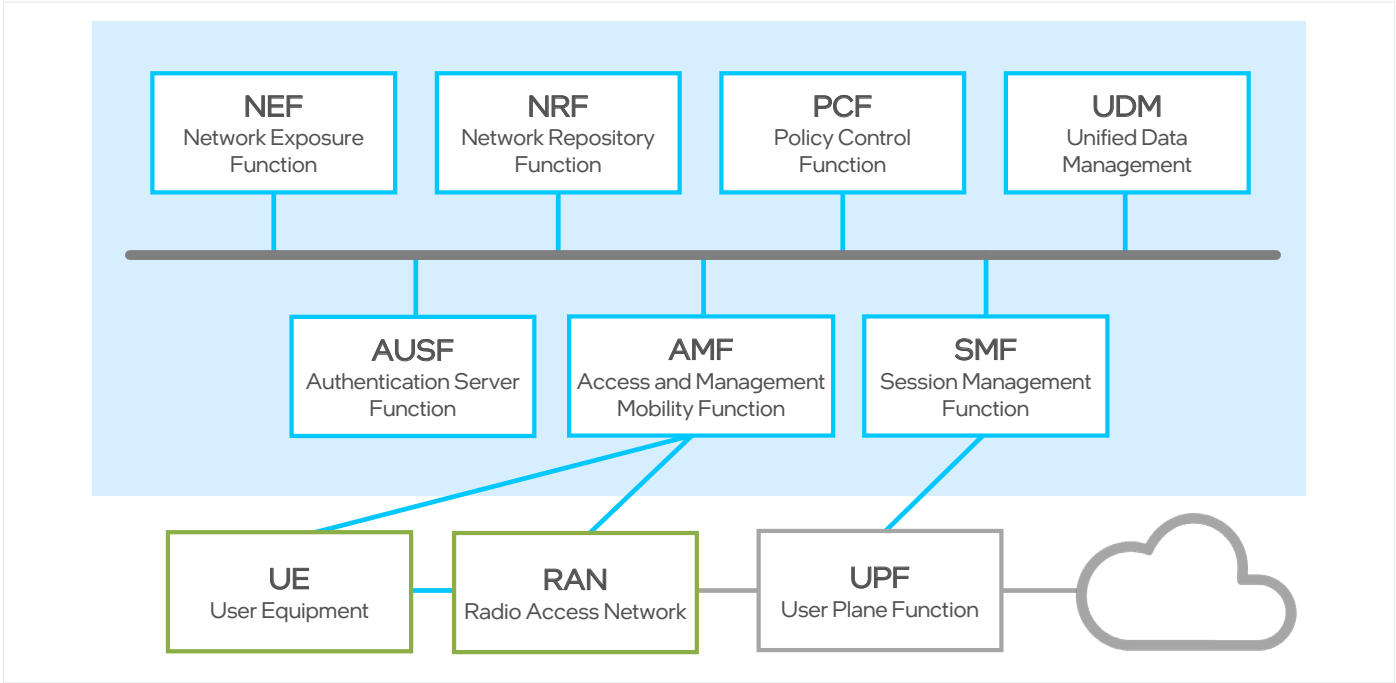

Figure 1. Core components of 5G virtual core.

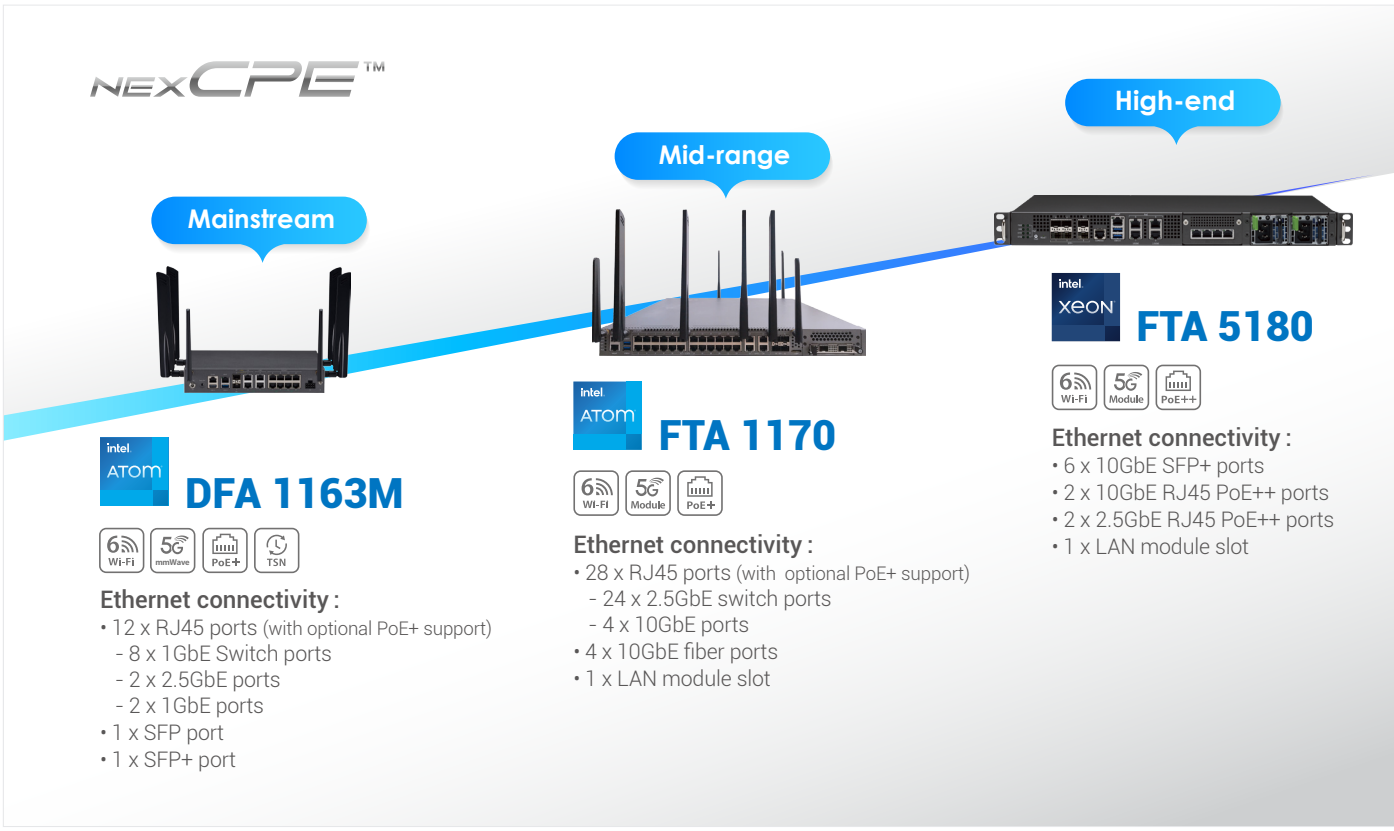

Figure 2. NEXCOM nexCPE™ product line.

Introducing the FTA 1170

The FTA 1170 is the mid-range system in NEXCOM's nexCPE™ professional uCPE product line for 5G and fixed wireless access applications. FTA 1170 is a flexible networking appliance to cover diverse 5G applications, for example, with equal success it can be used as a switch-server or a multi-access edge compute (MEC) server to provide large branch office needed processing and connectivity. Figure 2 shows more details about the wired and wireless capabilities of FTA 1170 as well as the rest of the nexCPE™ product line.

The 1U rackmount FTA 1170 has been designed with a significant amount of networking flexibility including four 10GbE copper ports, four 10GbE small form factor pluggable fiber ports and 24 2.5GbE switch ports. This allows the switch to provide access connectivity and to serve as the aggregation point for wireless networks as seen in Figure 3.

The 2.5GbE copper ports can also support power over Ethernet plus (PoE+), providing up to 25.5 Watts of power to a wide range of connected devices including webcams, Wi-Fi access points, or 5G modems. This support will be critical to wireless deployments in factories, ports, schools and stadiums where a large number of modems or access points must be installed in areas where power outlets are not available. This PoE+ support reduces deployment time and costs and makes the FTA 1170 a strategic choice for these locations.

The FTA 1170 optionally supports wireless connectivity modules that include 4G LTE, 5G FR1, and Wi-Fi 5/6. This flexibility allows the switch server to support smart factory or smart office use cases or deployments of pervasive IoT sensors. This universal wireless support allows companies to use the switch-server in the headquarters, branches or in factories, which simplifies procurement, maintenance and deployment.

This connectivity can be seen in a 5G application shown in Fig. 3 where a 5G small cell is connected to the server switch which can deliver a range of applications including interconnection to other switches for enterprise-wide connectivity, or using the power of the Intel Atom P5300, the server can run virtualized 5G core or distributed unit functionality.

FTA 1170 supports a maximum memory capability of 256GB tying into demand for higher memory capacity to support virtualization, real-time analytics, in-memory databases and other big data applications. For storage, the FTA 1170 features a built in 8GB Embedded Multi-Media Card (eMMC) and up to 5GB of storage, available in either a hard disk drive (HDD) or a solid state disk (SSD).

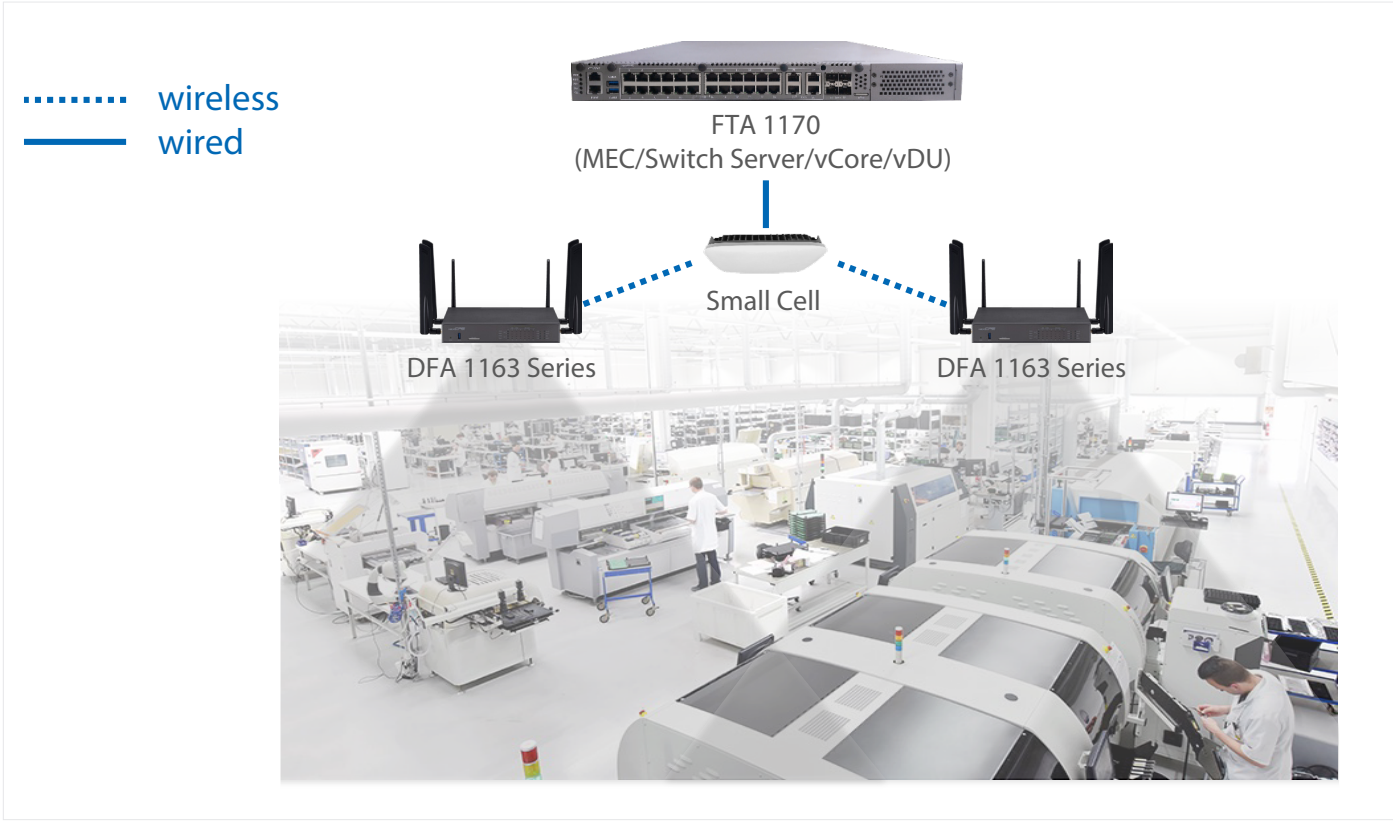

Figure 3. FTA 1170 used in private 5G application.

Leveraging the Intel Atom® P5300

For connectivity and compute performance, the FTA 1170 uses the Intel Atom® P5300 processor family. The CPUs are part of the Intel Atom P5000 product line that is designed for excellent packet processing performance with low latency. The Intel Atom P5300 product family ranges from eight to 24-cores operating at 2.2GHz with up to eight Ethernet ports supporting throughput between 10GbE and 100GbE.

The Intel Atom P5300 CPUs feature the Intel® Dynamic Load Balancer (DLB) that enables better and faster queuing for workloads between multiple cores than previous-generation Intel Atom processors. The Intel DLB is a PCIe device that improves the system performance related to handling network data by providing load-balanced, prioritized scheduling of core-to-core communication. DLB is dynamic and can distribute workloads across multiple CPUs as the system load varies.

The CPUs have built-in Intel® QuickAssist Technology (Intel® QAT) inline security acceleration for look-aside cryptography at 100 Gbps. Intel QAT can be used in network security applications including IPSec, SSL/TLS, and for hashing for data deduplication or encrypted storage.

The CPUs are equipped with a network interface and scheduler that offers advanced packet processing features including 100Gbps flexible packet parsing, advanced scheduling, and the use of Intel QAT for security and compression acceleration.

The Intel Atom P5300 offers both power-efficient compute and enhanced integrated network applications.

Conclusion

Private 5G networks are an emerging wireless option to provide universal, high-throughput wireless connectivity throughout an organization. It is already demonstrating significant value for organizations – ranging from manufacturing to healthcare to transportation. Thanks to virtualization of the RAN and 5G core, private 5G networks can be built using COTS servers which makes the cost accessible to enterprises.

The NEXCOM FTA 1170 is a COTS switch server. One of the applications for The NEXCOM FTA 1170 is private 5G because it offers ample of 10GbE and 2.5GbE connectivity combined with the compute performance of the Intel Atom P5300 CPU family. This combination makes the switch server the perfect aggregation point for a 5G network – collecting data from multiple base stations and also processing that data by the CPU which can also run applications including DU or 5G core services.While it is optimized for private 5G, the FTA 1170 can also be used for network oriented MEC applications such as branch office networking or edge network deployments.

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