SOLUTION BRIEF

Cloud RAN – Doing More with Less

Artesyn Features

- One quarter the cost per cell compared to pure server-sled-based solutions but with higher density and lower power consumption
- 100G intelligent network interface enables flexible, programmable forwarding of network streams as needed
- Up to 400G bandwidth support in half-width sled, with extension beyond single chassis allowing easy scaling
- Full virtualization support enables seamless scaling
- PCI Express based fabric delivers much improved latency over Ethernet-based solutions
- Form factors include 19" rack and Dell DSS 9000 for optimal integration into deployments without software or architecture changes
- PCI Express based architecture with hot-swap capable, NEBS-ready versions

C-RANs, or cloud-based radio access nodes, serve as the control unit in 4th and 5th generation networks. With 5G, they are becoming even more important in order to deliver the highly demanded short latencies and high speeds promised for these networks. C-RANs differ from vRANs, as vRANs are usually deployed much closer to the edge, whereas C-RANs reside in core data centers.

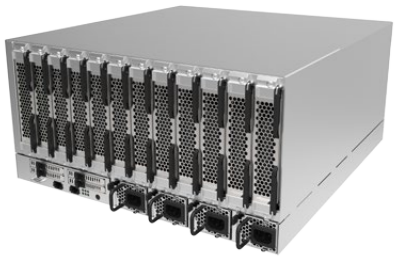
Depending on the actual implementation requirements (i.e., when building a shopping mall that from a network perspective is akin to a small city being served), scaled-down C-RANs, or so-called mini-C-RANs can be implemented. There are good reasons to select either of both implementations, depending on existing infrastructure and broadband connectivity to the different radio sites.

Some people confuse vRANs and C-RANs as they are very similar in function and character. By character, a vRAN is a virtualized C-RAN implementation and they have many things in common. If you are used to vRANs, you will find a lot of commonalities in this document.

For more information about the vRAN implementation, please see the *Build your vRAN with Lower CapEx and OpEx* solution brief.

MaxCore™ Hyperscale Platform

MaxCore™ High Availability Platform



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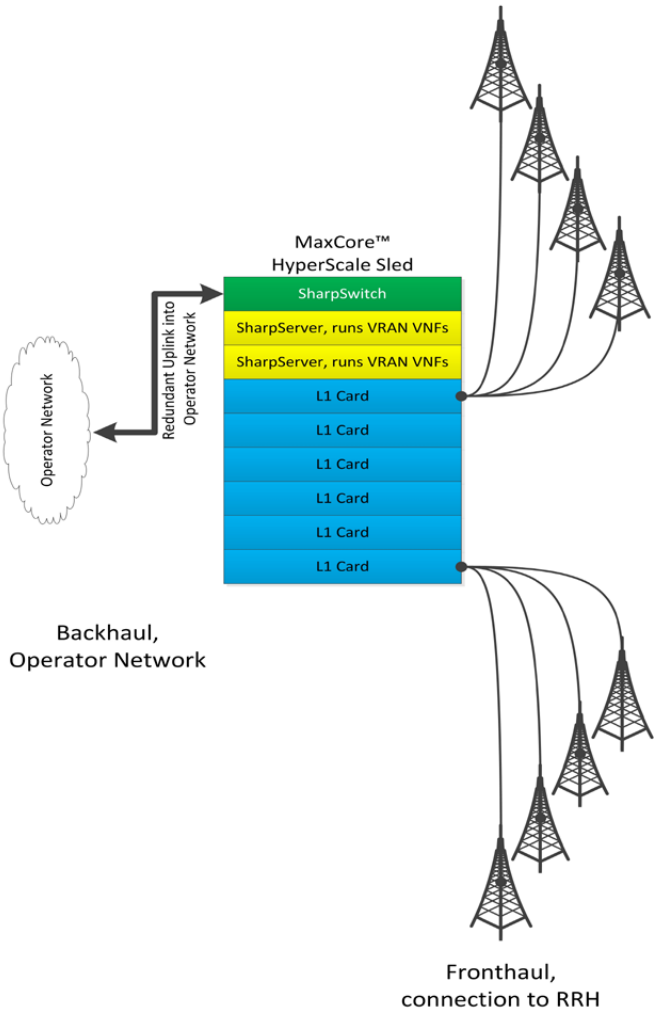
Implementation of a C-RAN

The actual implementation of a C-RAN is based on the same MaxCore™ architecture that was already demonstrated for the vRAN implementation, just in a different form factor. To operators and telecom equipment manufacturers (TEMs), this offers the major advantage of reuse of their implementation on one of these architectures, when moving to another one. The MaxCore architecture carries the same capability and "use and feel" across the different form factors. It also shows the same lowest-possible latencies that are required due to its use of PCI Express as the internal fabric rather than Ethernet. In this implementation, the ***MaxCore™ Hyperscale*** implementation is in the form of a sled that integrates into the Dell DSS 9000 racks.

The Artesyn MaxCore Hyperscale product – built around the Intel® Xeon® D processor family and paired with the Artesyn ***Silver Lining***™ virtualization software – creates an unprecedented level of both density and versatility when building virtualized C-RAN implementations.

C-RAN Diagram



With up to 338 processor cores and up to 400G bandwidth support, a single MaxCore Hyperscale half-width sled can support approximately 4x more cells (using today's L1 technology), in a compressed footprint and with a fraction of the power and cooling costs compared with a traditional sled approach, with resulting OpEx and CapEx savings. Virtualization techniques, paired with the latest I/O capabilities, enable short update cycles and remove potential bottlenecks in the hardware space that could hamper the success of these upgrades.

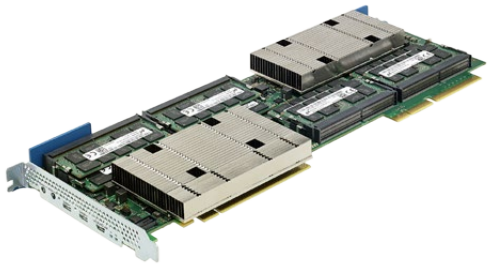
Capabilities and Architecture

By combining an off-the-shelf architecture with the unique ExpressFabric™ technology, the ***MaxCore Hyperscale*** platform allows consolidation of what would traditionally require multiple server sleds into a single appliance. With the ability to expand across multiple chassis and share central resources such as the 100G intelligent network interface cards, the MaxCore Hyperscale platform also removes the need for multiple top-of-rack (TOR) switches and combines all this into a single system configuration. I/O can easily be added using standard PCI Express cards (hot swap support subject to card specification). As a result, the MaxCore Hyperscale platform supports many more cells, while enabling much denser configurations.

How It's Done Using Intel Compute and Switching Silicon

Intel® has brought several silicon solutions to market that allow building new, denser solutions with more compute power than ever before. Artesyn has taken these different silicon kits and created a unique, flexible and scalable solution that takes the integration, density and flexibility to a new level, while keeping the flexibility of PCI Express cards fully intact.

PCIE-7410 SharpServer™ Card



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ExpressFabric PCI Express Switching with Virtual Function Support

The core of the MaxCore™ platform is built using the Avago (PLX) ExpressFabric PCI Express switching silicon. This silicon will operate either in a simple PCI Express based single root environment like any other PC, but it also allows operation in a virtualized mode that enables operating with multiple root complexes across the same backplane; as well as connecting the virtual functions of an I/O card to multiple root complexes, enabling a new level of sharing of resources. This operating mode is utilized for both C-RAN and vRAN to support the superior density and cost composition of the demonstrated solution.

Intel Xeon D Processor-based Microserver Cards and Functions

By combining two separate Intel® Xeon® D processor complexes on a single PCI Express card, a card of far higher density and versatility than in other architectures has been created. Utilizing the 16-core Intel Xeon D processor, 32 physical and 64 virtual cores are running in parallel in a single card, with virtualized access to every single I/O card in the system. The processors are running multiple virtual machines (VMs) alongside the chassis configuration management, which is run in one core of each of the two redundant microservers, taking away less than two of the 320 physical cores present in the total system configuration. The cell management and OAMT software is run in VMs spread out across multiple microserver cards, together with the L1 management software. One microserver card has the ability to manage four L1 interface cards in this configuration.

IP Interface: FM10xx0 ("RedRock Canyon") based, Intelligent 100G I/O Adaptor Cards

The uplink backhaul interface connecting the system to the outside world is created using two 100G SharpSwitch™ cards with redundant uplink interfaces. Based on the FM10xxx switch and network interface silicon, these cards have the capability to act as much more than just network interface cards. Hashing, intelligent forwarding, and distributing the packets received across a high number of virtual functions directly into the VMs running in the system are just some of the capabilities of this silicon. This technology paired with an Intel® Xeon® D processor complex on-board for further analysis and control functions, enables a very intelligent 100G card in a single slot. Again, additional VMs running additional functions can be deployed on the local processors.

Summary

The ***MaxCore*** family of products marries the versatility and superior cost/performance ratio of PCI Express cards with the requirements of telecom equipment, delivering higher density and better cost than traditional solutions. The required low latency is met using a PCI Express based internal fabric rather than an Ethernet-based architecture. This also does away with the need for expensive TOR switches and interconnect infrastructure. Due to a variety of different form factors with identical behavior from a management and development perspective, any implementation can be carried across to the various deployment models.

Artesyn's proven experience serving today's mobile network infrastructures, combined with product innovation and compliance with stringent industry certifications and quality levels, ensures our systems are designed to meet and exceed the demands of the LTE network and its evolution to 5G.

PCIE-9205 SharpSwitch™ Card

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