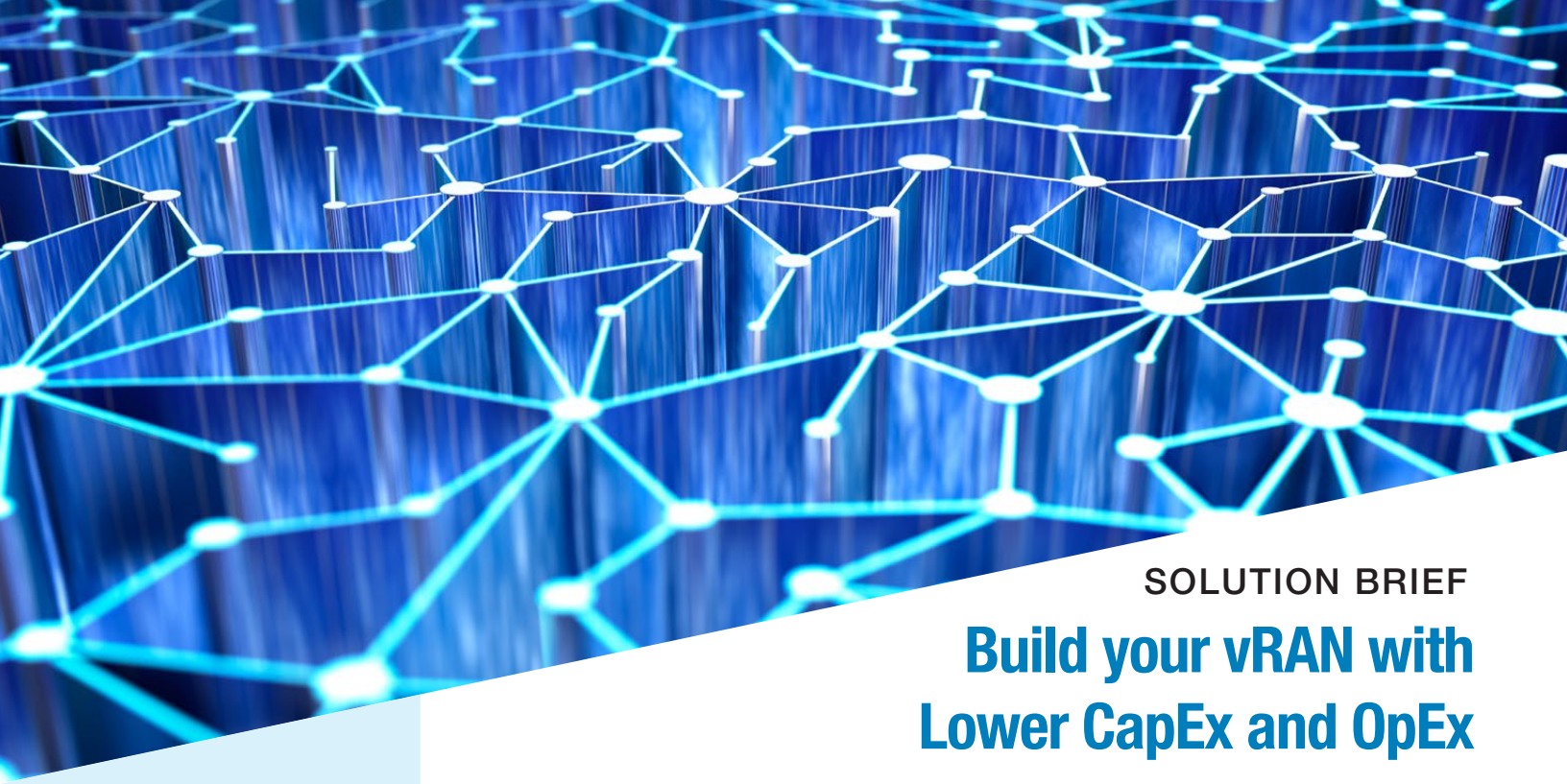


SOLUTION BRIEF

Build your vRAN with Lower CapEx and OpEx

Artesyn Features

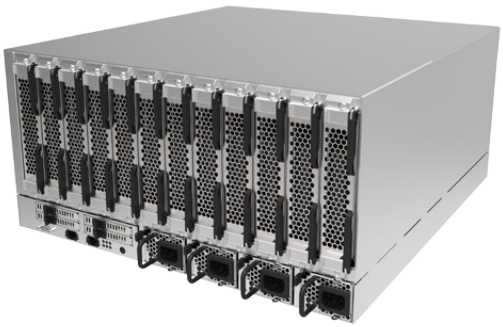
- Single MaxCore™ system can support an equivalent number of cells as 14 traditional servers
- One quarter the cost per cell compared to RMS-based solutions but with higher density and lower power consumption
- 100G intelligent network interface enables flexible, programmable forwarding of network streams as needed
- Up to 400G bandwidth support in 5U, with extension beyond single chassis allowing easy scaling
- Full virtualization support enables seamless scaling
- Hot-swap capable NEBS-ready PCI Express based architecture

The upcoming 5G network evolution stage demands higher bandwidth and lower latencies in network communication than ever before. This challenging set of requirements results in more and more functions – that used to be executed in the core – being forced to the edge of the mobile network. Multiplying these functions across the network calls for less expensive equipment building practices. Of course, existing telecom requirements such as NEBS Level 3 remain in force.

New network components like the cloud/virtualized radio access network (c/vRAN or FlexRAN) become the focus area to enable more versatile, less expensive network components while maintaining the requirements of communications infrastructure such as reliability and high availability. xRAN implementations are now in the process of replacing existing or new eNodeB deployments due to higher flexibility and better scaling possibilities and making their way into the upcomig Multi-Access Edge Computing (MEC) platforms as virtualized payload.The market shows there are multiple implementation possibilities, which result in different deployment models, all of which are ideally suited for the Artesyn *MaxCore*™ family of products.

The Artesyn *MaxCore™ High Availability* (HA) platform – 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 vRAN implementations.

MaxCore™ High Availability Platform



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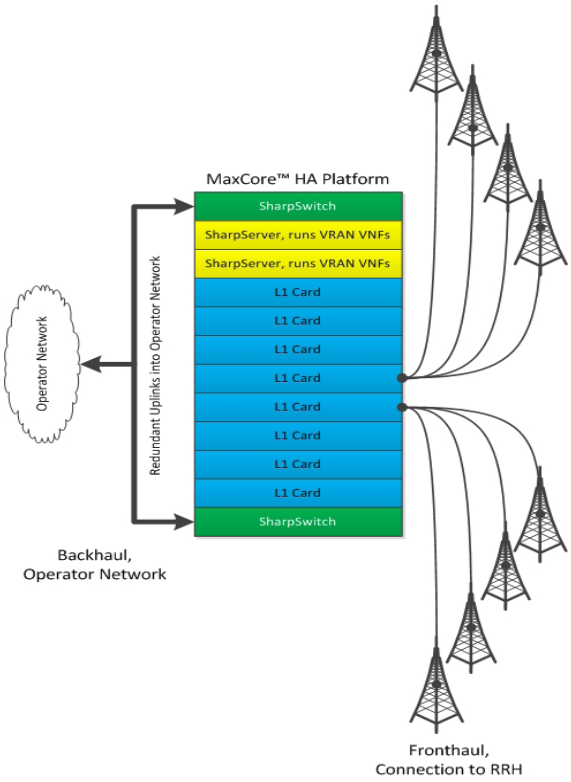
With up to 288 processor cores and up to 400G bandwidth support, a single MaxCore™ HA system can support an equivalent number of cells as 14 traditional rack mount servers (RMS) with a compressed footprint and with a fraction of the power and cooling costs. These virtualization techniques, paired with 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.

For more information about cRAN implementation, please see the "*Cloud RAN – Doing More with Less*" solution brief. Both vRAN and cRAN can run under the umbrella of the newly defined FlexRAN ecosystem, which also encompasses the Artesyn MaxCore family of platforms and boards.

Capabilities

By combining an off-the-shelf architecture with the unique ExpressFabric™ technology, the ***MaxCore HA platform*** allows consolidation of what would traditionally require multiple rack mount servers 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 HA 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 HA platform supports many more cells, while enabling much denser configurations.

vRAN Diagram



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.

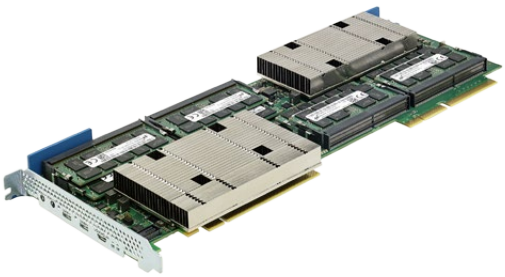
ExpressFabric PCI Express Switching with Virtual Function Support

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 this 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 12-core Intel Xeon D processor, 24 physical and 48 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 2 of the 240 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.

PCIE-7410 SharpServer™ Card



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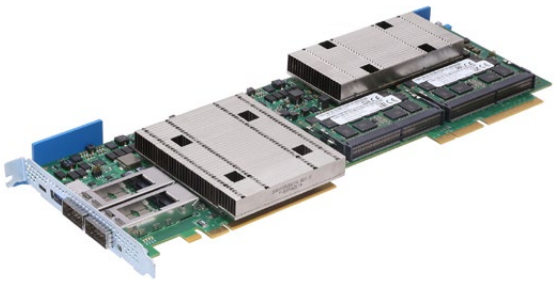
IP Interface: FM10xx0 ("RedRock Canyon") based, Intelligent 100G I/O Adaptor Cards

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.

PCIE-9205 SharpSwitch™ Card



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. 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.

By the Numbers
MaxCore™ HA System vs. RMS-based System

MaxCore™ HA System	120 Cells Capacity		
Item	**Number**	**Unit Power**	**U Size**
MaxCore HA Platforms	5	200 W	25
Microserver Cards	8	120 W	
L1 cards	30	40 W	
SharpSwitch Cards	2	100 W	
Interconnection Blades & Cables	16	30 W	
TOTAL		**3840 W**	**25**

RMS-based System	44 Cells Capacity		
Item	**Number**	**Unit Power**	**U Size**
TOR Switches	4	100 W	4
RAN (stacked 2U servers)	11	50 W	22
Clocking Servers	2	35 W	2
RMS/Single CPUs	14	250 W	14
TOTAL		**4520 W**	**42**

TCO Comparison

System Comparison	$/Cell	W/Cell	U/Cell
RMS-based System	$4,122	102.73 W	0.95
MaxCore HA System	**$1,097**	**32 W**	**0.21**

www.artesyn.com

+1 888 412 7832 or +1 602 438 5720

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