TELECOMMUNICATIONS: AN INDUSTRY IN THE MIDST OF TRANSFORMATION

PROVIDING THE NEXT GENERATION OF OCP FOR THE TELECOMMUNICATION SECTOR

THE TELECOMMUNICATIONS SECTOR IS EVOLVING AT AN UNRIVALLED SPEED AND IS FORECAST TO GENERATE REVENUE OF MORE THAN $1.7 TRILLION BY 2017. THE SECTOR STILL OFFERS PLENTY OF GROWTH OPPORTUNITIES BECAUSE OF NEW TECHNOLOGIES, SUCH AS INTERNET OF THINGS (IOT), BUT PROFIT PRESSURE PERSISTS.

Schroff Compute and Storage Rack

Ultra HD 4k TVs, on demand video, gaming and smart phones require ever increasing amounts of data. M2M connections that are forecast to reach 1 billion by 2020 and will represent 10% of all mobile connections, will add to the bandwidth needs. Telecom companies need to install new infrastructure and mobile equipment to support the data requirements and continue to meet customer's expectations.

Adding to this challenge, new telecommunication technologies have higher power densities, which increases the amount of power and cooling required per square foot of floor space. This has put pressure on system engineers to find innovative solutions to cope with these challenges– and the Open Compute Project (OCP) represents one of the options available.

Open Compute Project: an introduction

Founded in 2011, OCP is an industry-wide initiative to share specifications, designs and best practices for creating the most energy efficient and economical data centers. OCP membership includes some of the industry's leading firms, such as Facebook, Google, IBM, and Intel. To promote visibility and adoption, OCP specifications, designs and software are publically available.

In order to maximize the reliability of their equipment, telecom companies developed standards such as the Network Equipment Building System (NEBS). These standards have environmental and mechanical requirements that are much more stringent than required for datacenters. This has been a barrier to the adoption of OCP in the telecom market. In its standard configuration, OCP does not meet the requirements of NEBS in relation to shock and vibration resistance, temperature range and cooling performance. Therefore, a new generation of OCP is required to address the telecom industry.

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As more vendors in the Datacom market adopt the OCP specifications, more opportunities open for OCP technology to be adopted by the telecommunication industry.

The OCP community has recognized the need for:

- Bringing OCP innovations to telco data center infrastructure for increased cost-savings and agility
- Communicating telecom technical requirements effectively to the OCP community
- Getting the OCP ecosystem to address the deployment and operational needs of telecoms

There is a real opportunity for design engineers to find cutting-edge solutions that meet the growing need for high-performance economical systems, while meeting the specific application and industry standards for the telco sector. The OCP Telcos working group is defining an open compute solution which fits the needs of the telecommunication sector. While this specification effort is in the works telecom operators need solutions now. This is the reason why Pentair built the Schroff Compute and Storage rack based on the concepts of OCP.

Schroff: A new generation of OCP for the telecommunications industry

Using OCP as a base model, Pentair, along with a telecommunications operator and equipment manufacturer, developed a unique solution that meets the requirements for telecommunications applications and fulfils design considerations – the Schroff Compute and Storage Rack. The Pentair offering includes a rack with shelves, ToR (Top of Rack) switches, a power shelf, and Purpose built sleds for computing or storage applications.

Rack:

The 19" rack is based on the Schroff Varistar product series and is available either in 42U height, 800mm width and 1000 mm depth, or in 42U height, 600 mm width and 1200mm depth. A half-height evaluation/development unit is also available with dimensions of 16U, 600mm width and 1200mm depth for customers who want to validate this new technology.

The 800 mm wide rack has redundant 3-phase power input cables that enter through the top cover of the rack, with each cable going to a separate PDU (Power Distribution Unit) in the sides of the rack. The redundant PDUs feed AC power to the ToR Switches and power supplies. The bottom of the 800mm wide rack version holds 3x 1U power shelves that each accept 4x 2.5kW 12VDC front-end power supplies. The power supplies are in a 2x redundant N+1 configuration so the system can support full operation even with multiple failures. The 12V DC outputs of the redundant PSUs are connected to 2x sets of power busbars that provide the power to the Compute or Storage sleds. The 600mm wide rack has the same power supply configuration as the 800mm rack, but combines the PDU functions, and power supplies into a 4U height combination PSU/PDU unit. The combination PSU/PDU also contains a front pluggable Smart Rack Manager, which monitors the PSUs as well as an optional RDC (Rear Door Cooler) or optional electronic door locks. The optional RDC is prepared to enhance the cooling capacity and assist the environmental air conditioning. The smart rack controller includes the control logic that directly connects to temperature sensors that are used to control the RDC.

The ToR (Top of Rack) contains 2x redundant 1U fiber optic data plane switches, each having 32x 40 Gb or 96x 10 Gb + 8x 40 Gb ports. The ToR also holds 2x redundant 1U fiber optic Management switches each with 48x 1 Gb + 2x 10Gb ports. The fiber optic connections from the shelves to the ToR switches are included in the rack.

The rack comes either with 17x 2U full width shelves which accept Storage sleds, or 34x 2U half width shelves that hold Compute sleds, or any combination of both. The shelves are the mechanical "slots" for the sleds and provide the fiber optics mating connectors for the sleds, and the connection to the 12VDC bus bars.

Sleds:

As mentioned above, there are 2 types of sleds available: a Compute sled and a Storage sled. The Compute sled is 2U, half width and 800mm deep. An example configuration holds 2x Dual-socket Xeon motherboards each equipped with up to 256 GB (16x 16 GB) RAM. Each motherboard has 2x 10 Gb optical NICs for Data Plane, and 2x 1 Gb optical NICs for BMC and Management. An example Compute sled includes 2x 2 TB boot and application SATA SSDs. The Storage sled is 2U, full width and 800 mm deep. An example configuration could also contain a single Dual-socket Xeon motherboard with 2x 10 Gb optical NICs for Data Plane, 2x 1 Gb optical NICs for BMC and Management and up to 256 GB RAM. The Storage sled includes 2x 2 TB boot and application SATA SSDs, and 16x 8 TB SAS HDDs. The next generation of Storage sleds will contain 24 HDDs. Both types of sleds are hot swappable.

When choosing from the available telecommunications datacenter solutions design engineers must carefully consider factors such as flexibility, storage & power capabilities, effective use of available space, costs and thermal performance. The following section establishes how the Schroff Compute and Storage rack addresses these design criteria.

Storage sled

Compute sled

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Modular approach guaranteeing high grade of flexibility
System designers and end users need flexibility with their equipment design and performance. Based on the modular Varistar rack platform, the Schroff Compute and Storage rack can be easily customized. Pentair can modify the system's height, width and depth or color depending on the customer needs. Because Storage and Compute sleds can easily be combined in any configuration within the same rack, users benefit from greater flexibility. In addition, all electronics can be changed to fit the application, like vendor or model of the ToR switches, mainboards, HDDs, SDDs or PSUs.

Unlike competing system configurations, the Schroff Compute and Storage rack manager is front pluggable, meaning that it is easily accessible and removable. The technology allows for the addition of accessories such as electronic locks and a RDC. For customers who want to build their own server mainboard for the sleds Pentair has a reference design for a Baseboard Management Controller (BMC) available, either with or without KVM remote control. The BMC monitors and controls the performance of the hardware against multiple criteria, such as temperature, voltages and fan speed. With a BMC installed on the sleds (either Compute, Storage or both), users can connect the system either via a desktop computer or a system management software, mount virtual drives or even reboot it.

Staying with the traditional U increment of 44.45 mm allows for the use of standard components such as 1U switches or 1U frontend PSUs. The U increment rack can also accept legacy 19" hardware in certain parts of the rack.

Optimal storage and processing capabilities
The rack uses the available space very efficiently. Either 17 Storage sleds with each 16 or 24 HDDs with 8 TB capacity can fit into one rack. This adds up to 3264 TB of storage capacity for the complete rack. If equipped with only Compute sleds, 34 sleds fit into the rack. Example sleds contain 2 Dual-socket server mainboards each, a maximum of 136 Xeon processors can be installed into the Schroff rack in this example.

Effective use of available space
Compared to other Telecom standards like AdvancedTCA, the Schroff Compute and Storage rack has a much higher processing and/or storage density. The newest versions of ATCA chassis typically have a height of 14U. Three 14U ATCA chassis fit into a 42U rack. One chassis can hold up to 14 blades. Considering 2 of those blades are switch blades, 12 processor blades fit into each of the 3 systems. With that a maximum of 36 Dual-socket processor blades, means 72 Xeon processors can be installed in a rack, compared to 136 in the example Schroff Compute and Storage rack. When used for storage, you can install 36x ATCA storage blades, each with a capacity of 7.2 TB, for a total of 259.2 TB. That compares to 3264 TB of storage capacity for a Schroff Compute and Storage rack.

Advanced thermal performance
Electronic devices generate excess heat, requiring thermal management to improve reliability and prevent premature failure. With racks, cool air is often drawn in through the front door and expelled from the rear of the rack. With a standard 19'' system and typical horizontally and vertically aligned boards, fan cooling is usually needed so that the air moves effectively through the system. For vertically mounted blades, air plenums take up space above and below the card cage. The Schroff Compute and Storage rack is designed with a straight air flow from front to back, over the electronic components and heat sinks. As a result, no air plenum is needed and this space can be used for the electronics. The straight through air path means that the need for fan cooling is minimized, reducing costs. If the air handlers in the datacenter are inadequate, you can add an RDC to the rack. The RDC is controlled by the smart rack management controller, and can cool up to 50KW. With this concept, no additional active fans or pumps are needed. The fans inside the sleds push the warm air through the RDC where it is absorbed by the datacenter's chilled water.

Pentair also offers expertise on cooling technology based on components such as the chassis and rack, including forced air-cooling or air-to-water cooling. Pentair can also provide thermal simulation to determine the required cooling performance.

Highly reliable system
With traditional telecoms systems such as AdvancedTCA, each component is redundant to allow seamless operation, significantly increasing costs. The new Schroff Compute and Storage rack adopts an alternative redundancy concept. Instead of duplicating each component as in an ATCA shelf, the storage and processors in a Schroff Compute and Storage rack will be installed with as little as 10% overhead. If a HDD, processor or even a sled fails, the task is simply shifted to another device. This guarantees seamless operation and reduces the hardware overhead from 100 to 10%. Some functions like rack power input, power conversion or data plane switching typically remain 100% redundant. The Schroff Compute and Storage rack is robust and reliable, guaranteeing continuous operation. It is optimized for telecom applications, is UL certified and is NEBS compliant. This means that it remains functional for 96 hours at 55ºC, and is resistant to earthquake zone 2 for a single a rack, or zone 4 with a row of racks.

Opportunity for customization
Working with Pentair to specify and select a Schroff system provides the opportunity for extensive customization. This new technology is based on the highly robust and efficient Schroff Varistar standard rack family. The sled mechanics are based on the modular Interscale-M chassis which is EMC shielded and optimized for modifications or customization. From small to large systems, Pentair specializes in customization to adapt the solution to meet specific customer requirements.

Significant costs saving
As opposed to costly special hardware, standard server mainboards can be installed within the Schroff Compute and Storage rack which minimizes costs. Thanks to its intelligent air flow concept, power consumption during operation is reduced to a minimum. Additional cost savings and space savings have been achieved by having sleds that directly plug into the rack, compared to the traditional concept of a system with blades installed inside a rack.

Industry outlook: protecting the technology that connects the world
Telco applications require high reliability and extremely sophisticated system management that keeps the system

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running in the event of an individual component or sub-system failure. In today's telecommunication sector, the demand for processing technologies with higher storage and power capabilities has never been more crucial. At the same time, system operators are looking to minimize costs. While OCP designs offer multiple cost and performance benefits, there is a real need for system solutions able to meet the specific requirements of the telecom industry.

Further developments and new approaches still need to be developed so that today's technology can really make a difference in the way communications networks are built and deployed.

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The Schroff brand offers an extensive portfolio of accessories for protecting printed circuit boards, such as card retainers, conduction-cooled board supports, front panels and handles, subracks, cases, backplanes, power supplies, cabinets and pre-assembled chassis for embedded computing systems as well as hardware management systems. For further information, please visit **www.pentairprotect.com**

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