The novelty of this packaging design approach is to make limited changes to heritage design and increase its chance to meet a project's stringent radiated emissions requirement. Without employing a raised surface or using a pedestal, the act of using conductive tape to seal the leakages from the connectors becomes harder, because the tape may not fully enclose the gap between the connector and the chassis. Having some elevation gives that additional surface area for the conductive tape to fully enclose the gap. The alternative to the pedestal would be to implement a gasket design as mentioned in the previous paragraph.

With this approach to packaging, D-connectors and micro-D connectors that have long been considered a weak point for radiated emissions can be improved by using conductive tape and raising the surface area of where the connector is mounted. This gives enough surface area for the tape to fully enclose the gap between the connector and chassis, and between the cable plug and connector receptacle. This is a simple solution to reduce the impact of radiated emissions leakage from D-connectors and micro-D connectors.

RF Reference Switch for Spaceflight Radiometer Calibration

Goddard Space Flight Center, Greenbelt, Maryland

The goal of this technology is to provide improved calibration and measurement sensitivity to the Soil Moisture Active Passive Mission (SMAP) radiometer. While RF switches have been used in the past to calibrate microwave radiometers, the switch used on SMAP employs several techniques uniquely tailored to the instrument requirements and passive remote-sensing in general to improve radiometer performance. Measurement error and sensitivity are improved by employing techniques to reduce thermal gradients within the device, reduce insertion loss during antenna observations, increase insertion loss temporal stability, and increase rejection of radar and RFI (radio-frequency interference) signals during calibration.

The two legs of the single-pole double-throw reference switch employ three PIN diodes per leg in a parallel-shunt configuration to minimize insertion loss and increase stability while exceeding rejection requirements at 1,413 MHz. The high-speed packaged diodes are selected to minimize junction capacitance and resistance while ensuring the parallel devices have very similar I-V curves. Switch rejection is improved by adding high-impedance quarter-wave tapers before and after the diodes, along with replacing the ground via of one diode per leg with an open circuit stub. Errors due to thermal gradients in the switch are reduced by embedding the 50-ohm reference load within the switch, along with using a 0.25-in. (≈0.6-cm) aluminum pre-backed substrate.

Previous spaceflight microwave radiometers did not embed the reference load and thermocouple directly within the calibration switch. In doing so, the SMAP switch reduces error caused by thermal gradients between the load and switch. Thermal issues are further reduced by moving the custom, high-speed regulated driver circuit to a physically separate PWB (printed wiring board). Regarding RF performance, previous spaceflight reference switches have not employed high-impedance tapers to improve rejection. The use of open-circuit stubs instead of a via to provide an improved RF short is unique to this design. The stubs are easily tunable to provide high rejection at specific frequencies while maintaining very low insertion loss in-band.

An Offload NIC for NASA, NLR, and Grid Computing

New acceleration engine provides the functions of network acceleration, encryption, compression, packet-ordering, and security.

Goddard Space Flight Center, Greenbelt, Maryland

This work addresses distributed data management and access — dynamically configurable high-speed access to data distributed and shared over wide-area high-speed network environments. An offload engine NIC (network interface card) is proposed that scales at n×10-Gbps increments through 100-Gbps full duplex. The Globus de facto standard was used in projects requiring secure, robust, high-speed bulk data transport. Novel extension mechanisms were derived that will combine these technologies for use by GridFTP, bandwidth management resources, and host CPU (central processing unit) acceleration. The result will be wire-rate encrypted Globus grid data transactions through offload for splintering, encryption, and compression.

As the need for greater network bandwidth increases, there is an inherent need for faster CPUs. The best way to accelerate CPUs is through a network acceleration engine. Grid computing data transfers for the Globus tool set did not have wire-rate encryption or compression. Existing technology cannot keep pace with the greater bandwidths of backplane and network connections. Present offload engines with ports to Ethernet are 32 to 40 Gbps f-d at best. The best of ultra-high-speed offload engines use expensive ASICs (application specific integrated circuits) or NPUs (network processing units). The present state of the art also includes bonding and the use of multiple NICs that are also in the planning stages for future

portability to ASICs and software to accommodate data rates at 100 Gbps.

The remaining industry solutions are for carrier-grade equipment manufacturers, with costly line cards having multiples of 10-Gbps ports, or 100-Gbps ports such as CFP modules that interface to costly ASICs and related circuitry. All of the existing solutions vary in configuration based on requirements of the host, motherboard, or carrier-grade equipment.

The purpose of the innovation is to eliminate data bottlenecks within clus-ter, grid, and cloud computing systems, and to add several more capabilities while reducing space consumption and cost. Provisions were designed for interoperability with systems used in the NASA HEC (High-End Computing) program. The new acceleration engine consists of state-of-the-art FPGA (field-programmable gate array) core IP, C, and Verilog code; novel communication protocol; and extensions to the Globus structure. The engine provides the functions of network acceleration, encryp-tion, compression, packet-ordering, and security added to Globus grid or for cloud data transfer. This system is scalable in n×10-Gbps increments through 100-Gbps f-d. It can be interfaced to industry-standard system-side or network-side devices or core IP in increments of 10 GigE, scaling to provide IEEE 40/100 GigE compliance.