

Dell Open RAN Accelerator Card

Summary

Open RAN solutions have been challenged to meet the performance levels of traditional RAN deployments. While there are multiple factors contributing to this, a critical factor has been the performance of layer 1 computations within the virtualized Distributed Unit (vDU) of the Open RAN architecture. Simply put, current vDU deployments have drawbacks and inefficiencies in processing layer 1 computations.

To address this, Dell and Marvell Technologies have collaborated to develop an in-line layer 1 accelerator card that increases the efficiency and overall performance of the vDU, helping to close the performance gap and make Open RAN a reality.

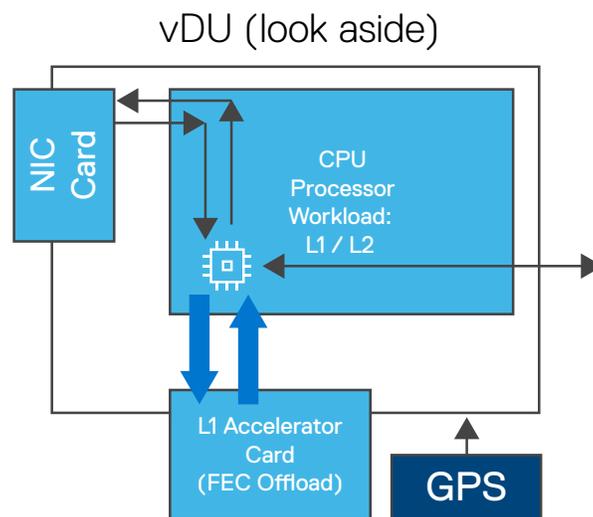
Performance is critical to Open RAN success

Open RAN is a vital component to the future success of 5G and gives Communications Service Providers (CSPs) more choice and flexibility in how they deploy their radio networks. The ability to extend radio capacity quickly, efficiently, and cost-effectively will be instrumental in enabling CSPs to accelerate the deployment and monetization of 5G services.

CSPs must achieve cost/performance parity with traditional RAN systems for Open RAN to succeed. However, this has been challenging to date. One of the main reasons Open RAN has lacked the performance of traditional RAN has been the virtualized Distributed Unit (vDU) performance when running on commercial-off-the-shelf (COTS) servers. The vDU plays a critical role in Open RAN, including processing layer 1 (physical layer) and layer 2 computations. Today, layer 1 and layer 2 computations in traditional RAN systems are performed in purpose-built, highly optimized Baseband Unit (BBU) hardware. The performance gap between Open RAN vDUs and the BBU creates early challenges that hinder wider Open RAN acceptance.

The challenge of today's layer 1 processing

A key drawback to the performance of early Open RAN deployments is how layer 1 activities are processed. In the Open RAN split 7.2 architecture, layer 1 is split between the lower layer 1 and upper layer 1. The radio unit processes the lower layer 1 functionality, while the vDU processes the upper layer 1 functionality on COTS servers. Our experience has shown that, for vDUs to deliver performance in parity with appliance-based BBUs, efficient layer 1 processing is critical.



Current 'look-aside' approach of today's Open RAN vDU

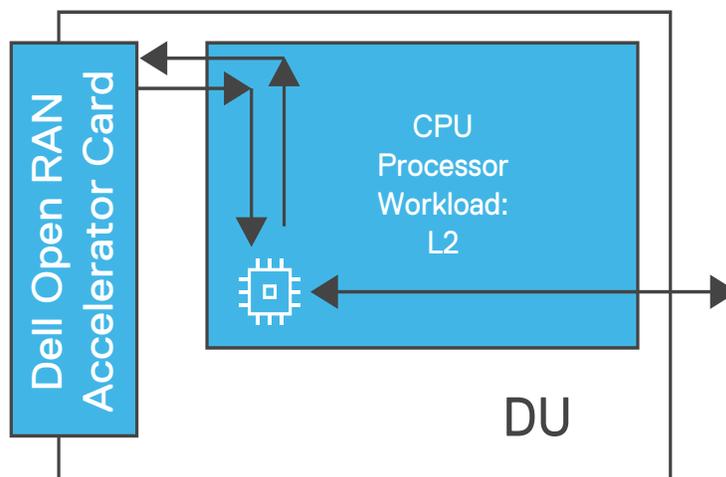
Current Open RAN deployments process the layer 1 functions in the vDU using a 'look-aside' approach. The look-aside approach leverages a layer 1 accelerator to conduct only a subset of layer 1 functions, specifically for Forward Error Correction (FEC). The look-aside approach creates a lot of inefficient back-and-forth communications between the server's central processing unit (CPU) and the FEC accelerator card. These back and forth communications create significant inefficiencies resulting in a decrease in the overall performance of the vDU and Open RAN system. In addition, since the FEC accelerator card only does a subset of layer 1 processes, the server CPU must process some of the layer 1 computations, which it is not optimized to handle. Today's look-aside approach is a primary cause for the performance gap between traditional RAN and Open RAN systems.

The Dell Open RAN Accelerator Card

Dell and Marvell Technology have collaborated to create a new Open RAN accelerator card that processes all layer 1 functions in-line, greatly enhancing the performance of the Open RAN vDU. The Dell Open RAN accelerator card eliminates the look-aside approach drawbacks of current vDU solutions with complete layer 1 in-line processing. The Dell Open RAN accelerator card interfaces with the radio unit and processes all layer 1 computations, freeing up valuable server CPU cores and eliminating the need for a fronthaul network interface card (NIC)

Dell's Open RAN Accelerator Card utilizes the OCTEON Fusion CNF95xx chipset from Marvell — the same chipset used in traditional RAN solutions by large-scale deployed vendors today. The Marvell chipset includes a mix of digital signal processors (DSPs) and advanced RISC machine (ARM) cores uniquely suited for layer 1 computations. Moving all layer 1 processes to the accelerator card allows the server CPU to focus on what it does best: layer 2 computations. The Dell Open RAN Accelerator Card reduces the required number of server CPU cores, helping to reduce overall power consumption and overall costs. The result is an open, best-of-breed RAN solution that offers performance in parity with traditional RAN systems.

Beyond Marvell's industry-leading chipset technology, the Dell Open RAN Accelerator Card includes essential features such as a built-in GNSS timing module, embedded MACsec encryption, and integrated Dell Remote Access Controller (iDRAC) technology. Until now, vRAN and Open RAN solutions required a separate timing module, which added to the cost and complexity of next-generation RAN systems. Adding the timing module into the Dell Open RAN Accelerator Card enables all timing requirements — from precision time protocol (PTP) to Synchronous Ethernet (SyncE) — to be handled right out of the box with no need for additional hardware before connection to the GNSS antenna. The iDRAC is designed for secure local and remote server management and helps administrators deploy, update, and monitor Dell EMC PowerEdge servers anywhere, anytime. This is essential for geographically dispersed RAN infrastructure where physical access to servers may be a challenge. The Dell Open RAN Accelerator Card connects to a standard PCI Express (PCIe) slot, enabling it to run on Dell and other COTS servers.



Layer 1 processing with the Dell Open RAN Accelerator Card

Key Benefits

The Dell Open RAN accelerator card provides critical functionality to enable more efficient layer 1 processing, including:

- Performs all layer 1 calculations in-line, completely offloading layer 1 calculations from the server CPU
- Frees up the server CPU to focus on the layer 2 workloads that it is optimized to handle
- Reduces the server CPU core requirements, helping to reduce power consumption and overall costs
- Simplifies overall vDU deployments by eliminating the need for a separate fronthaul NIC and GPS timing

Solution Highlights

The Dell Open RAN Accelerator Card offers CSPs a number of benefits including:

- Increases vDU and overall RAN performance by eliminating look-aside communications and conducting all layer 1 computations inline, freeing up the server CPU for layer 2 workloads
- Simplifies vDU deployments by removing the need for additional fronthaul NIC, GPS timing, and FEC offload accelerator cards
- Provides flexibility and choice through a standard PCIe interface