

OVS Kernel Datapath Offload at 100GbE

Using Qualcomm Centriq 2400 Arm Platform & Chelsio T6 Adapter

Executive Summary

This paper introduces Chelsio’s excellent OVS datapath offload capabilities by comparing packet processing rate and CPU usage of offloaded and non-offloaded OpenFlow network traffic. Chelsio’s T6 offload scores a substantial 47 MPPS with negligible CPU usage proving that Chelsio’s offering can successfully leverage SDN deployments in datacenters using Open vSwitch (OvS) technology.

Chelsio Unified Wire’s leading-edge performance and efficiency for networking, storage, and security applications combined with the Qualcomm Centriq 2400, the world’s first 10-nanometer server processor, offer a complete best-of-breed 64-bit Arm-based infrastructure for cloud datacenters. The coupling of the Qualcomm Centriq 2400 processor based QDF2400 REP server with Chelsio’s industry-leading Unified Wire adapter solution delivers compelling performance, power and total cost of ownership (TCO) advantages. This enables innovative topologies and networked computing models to address the most demanding cloud datacenter infrastructure needs.



Figure 1 - QDF2400 REP Server and T6 adapters

Chelsio OVS Kernel Datapath Offload for small I/O packets (64B)

Open vSwitch is a multilayer software switch and is suited to function as a virtual switch in VM environments, where Hypervisors need the ability to bridge traffic between VMs and with the outside world. Open vSwitch’s forwarding path (the in-kernel datapath) also known as OVS DP, is designed to be amenable to "offloading" packet processing to hardware chipsets, in a classic hardware switch chassis or in an end-host NIC. The advantage of hardware integration is that both bare-metal and virtualized hosting environments can be managed using the same mechanism for automated network control.

Chelsio’s T6 Unified Wire solution offloads OVS datapath flow match entries and action processing onto Chelsio adapter and provides the hardware acceleration. This is achieved by adding, removing and synchronizing the OVS flow table entries on adapter with following capabilities:

- Offloaded kernel datapath, Acceleration via Match, Action, Tunnels and lookups Offload to NIC. OVS flow tables offloaded to adapter
 - Match / Action supported at the Port
 - L2 learning for new flows (hit/miss)

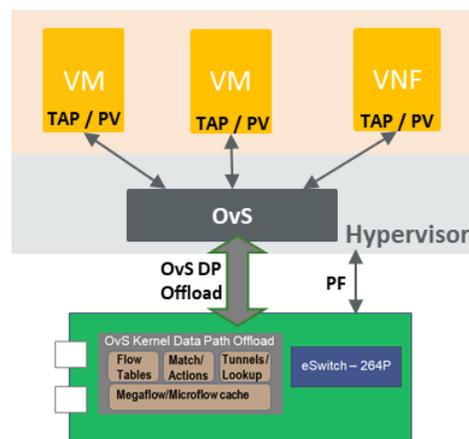


Figure 2 - Chelsio OVS offload solution

- NVGRE/VXLAN tunnel encap/decap, Header caching / Hardware offloading
- OVS monitoring and statistics: Retrieving flow statistics (viz. flow-hit count, etc.)
- WDP (wildcard datapath) abstraction/offload

Chelsio 1/10/25/40/50/100Gb ethernet solution scales to a true line rate operation, from a single TCP connection to thousands of connections and supports offloading for both OpenFlow and non-OpenFlow network traffic simultaneously.

Test Results

The following graph presents packet processing rate (MPPS) and CPU utilization for offload and non-offload OpenFlow network traffic. The results are collected using **pktgen** tool with I/O size 64B and the number of OpenFlows varying from 1 to 10k.

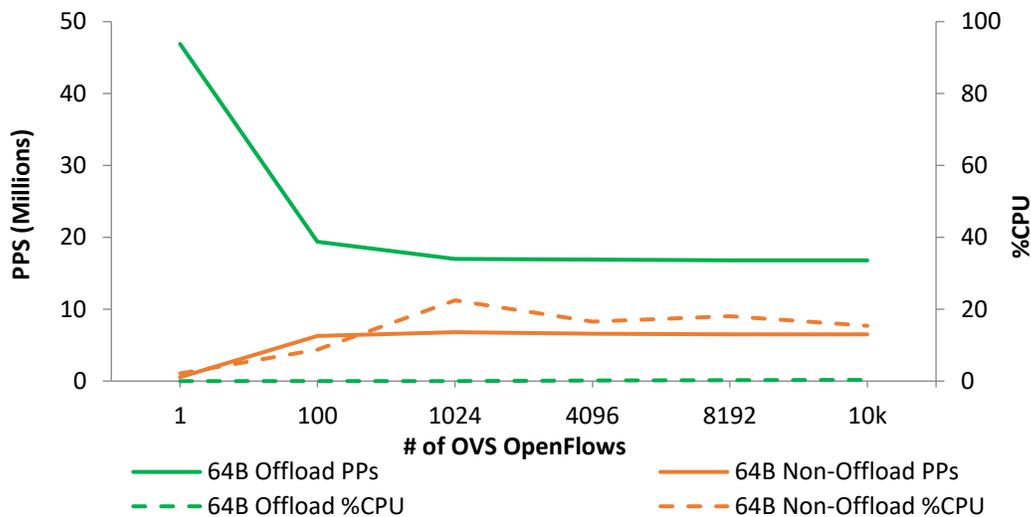


Figure 3 - PPS and %CPU vs. Number of Flows

Chelsio T62100-CR adapter delivers up to 47 MPPS while processing small I/O size (64B) network packets by offloading OVS kernel datapath to the adapter, freeing CPU for other applications. This reflects the performance advantages of Chelsio's offload solution, particularly at the challenging small I/O sizes that are more representative of actual application requirements. Even as the number of flows increase beyond 100, the offload solution achieves upto 2x the MPPS of non-offload. Even with 10k flows, the maximum CPU usage reported is 0.34%, proving the worth of offload.

Test Setup

The test setup consists of 2 Client machines connected to an OVS Switch (Qualcomm QDF2400 REP Server) machine using single 100Gb link. MTU of 9000B is configured on all the machines. Chelsio Unified Wire v3.5.0.5 is installed on all the machines.

The following diagram provides the test setup and configuration details:

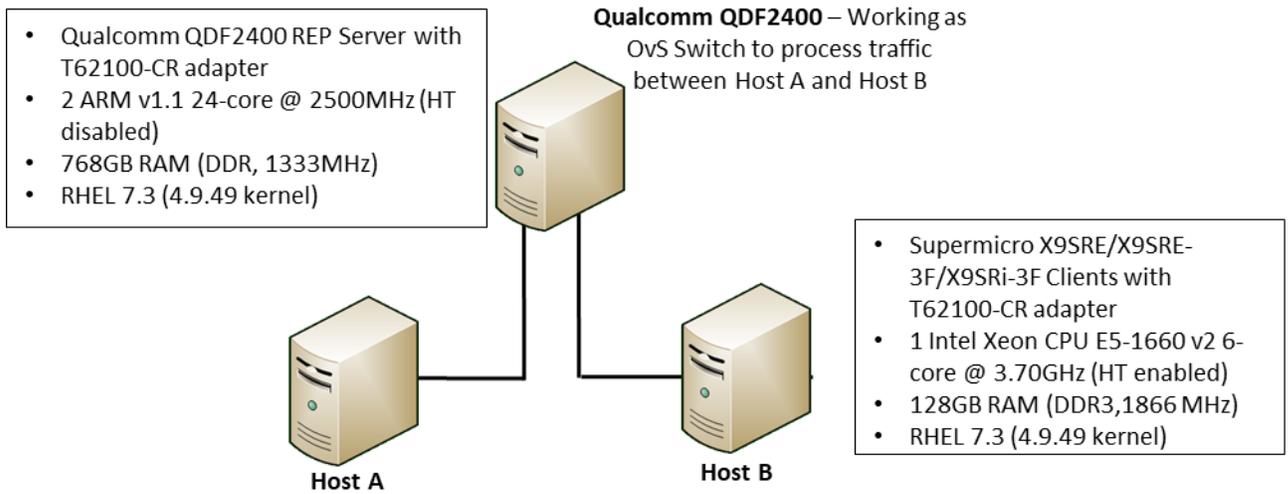


Figure 4 – Test Setup

Conclusion

This paper showcases the OVS offloading capabilities of Chelsio T62100-CR Unified Wire adapter in a Qualcomm Arm based server. The results show extraordinary packet processing performance for offloaded OpenFlow network traffic with up to 47 MPPS. The CPU usage for such an exceptional performance was minimal across the board, representative of an efficient processing path.

Chelsio OVS offload solution offers upto 2x the packet processing rate of regular NIC, negligible CPU usage and superior scaling with large number of flow entries.

Related Links

- [The Chelsio Terminator 6 ASIC](#)
- [OVS Kernel Datapath Offload Solution](#)
- [Chelsio 100G DPDK Performance](#)
- [Linux 40GbE DPDK Performance](#)