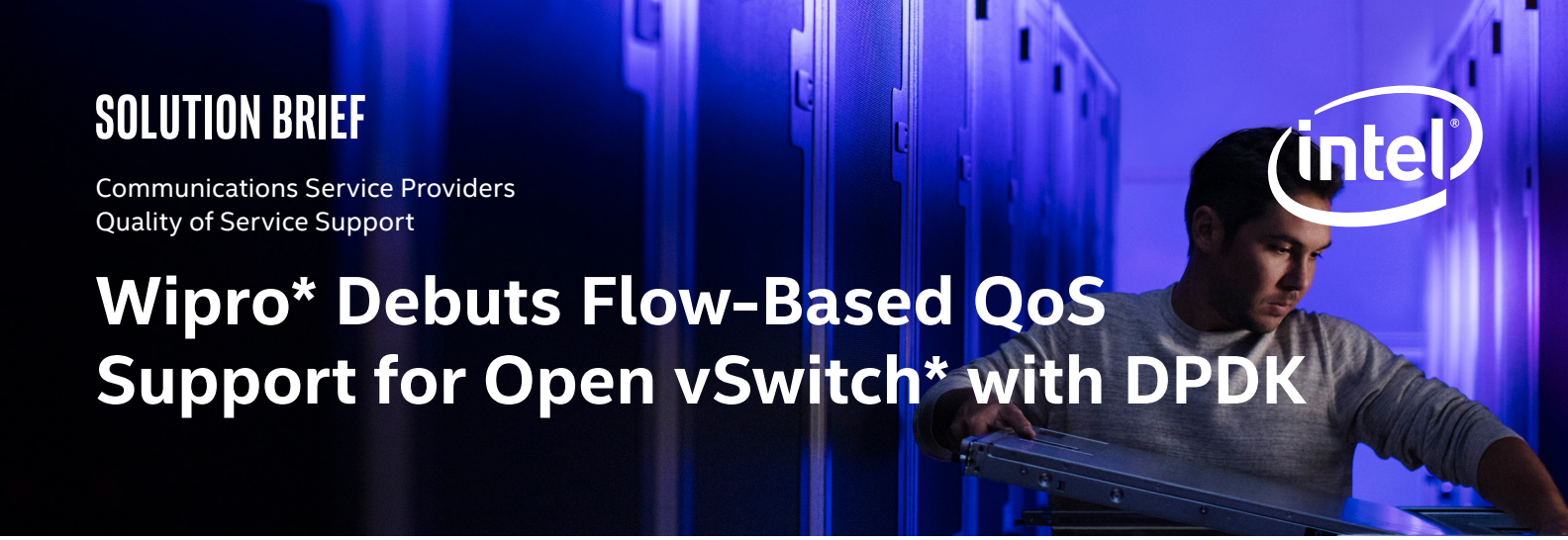

SOLUTION BRIEF

Communications Service Providers
Quality of Service Support

Wipro* Debuts Flow-Based QoS Support for Open vSwitch* with DPDK

Quality of service (QoS) software adds priority queues to assure the performance level of DPDK-accelerated Open vSwitch for video, voice services.

Overview

Data bandwidth demand is driven by video content as consumers watch streaming video services on their computers, tablets, or smart mobile devices. Businesses are demanding service level agreements to ensure that they can provide the desired user experience level for priority services like multimedia streaming, voice over IP, and real-time database access to their employees.

To meet these needs, communications service providers (CommSPs) need to ensure low-latency, low-jitter network switching and implement quality of service (QoS) technology to deliver the required service levels. As a member of Intel® Network Builders ecosystem, Wipro* has developed Flow-Based QoS for Open vSwitch* with DPDK implementations to enhance throughput for NFV-based video and voice services.

The Challenge

NFV services depend on virtual network functions (VNFs) communicating via a virtual network operating within a server. The networking services are realized using Open vSwitch (OVS)* that provides a bridging function for all the connected physical and virtual Ethernet interfaces. QoS is available on OVS, but it has a few limitations and conditions:

1. Even with QoS enabled on OVS, the requirements for latency and bandwidth assurance by some VNFs may not be met adequately as per the current implementation. This is due to the fact that OVS architecture has some performance limitations related to how packet flow updates are made to the fast path flow table. The process requires a time-consuming context switch between kernel and user space for the first packet in each data flow. This means that the achievable packet throughput is limited by the packet forwarding rate of the Linux* OS.
2. The current QoS architecture of OVS without DPDK supports only physical Ethernet interfaces. There is a need to support the same for virtual Ethernet interfaces as well.
3. There is a need to support per-flow based QoS to enable dynamic service function chaining (SFC), which is not currently available.

Wipro's QoS Solution Overview

Wipro's QoS solution addresses these three challenges. OVS is a popular, open source multilayer virtual switch that offers a QoS function for both ingress and egress traffic. For ingress traffic, OVS uses traffic shaping logic to establish queues

and guarantee a packet flow rate (both minimum and maximum) through the switch based on the queues. Packets are tagged with their priority levels based on their payloads or other packet information.

OVS QoS provides guaranteed rate of packet flow for all packets in a particular queue. Alternatively, a traffic policing QoS technology is available on the egress traffic port of the OVS. Traffic policing drops packets received in excess of the queue's configured rate. While effective at reducing switch contention, policing is less efficient and accurate at maintaining QoS priorities.

OVS with DPDK overcomes the QoS challenge by bypassing the Linux networking stack and switching packets directly between user space and the network interface card (NIC). While this makes a significant difference in vSwitch throughput, the current implementation of OVS with DPDK supports physical and virtual devices but is limited to egress policing only. There is still a need for QoS for packet prioritization, which is not supported in the current OVS implementation.

Wipro's Flow-based QoS for OVS with DPDK software provides this missing functionality by introducing flow-prioritization, packet classification, and traffic shaping capability on an egress queue of OVS with DPDK. Wipro leverages OpenFlow*-based software-defined networking (SDN) to solve the problem of providing priority queues for OVS with DPDK without the need to tag the packets as they enter the switch.

These packets are queued at the switch's DPDK scheduler where a rate-limiting algorithm performs traffic shaping by delaying low-priority packets so that high-priority traffic can pass first.

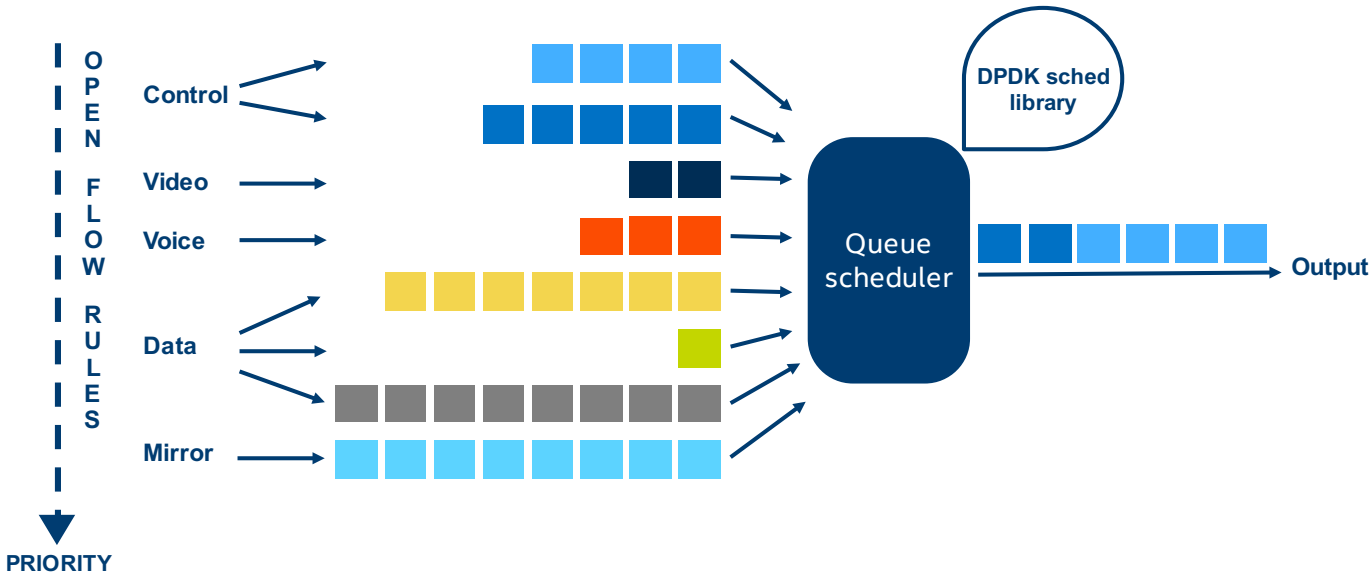

Figure 1. Priority queuing for Flow-based QoS for OVS with DPDK

Overall, the software QoS implementation reduces packet loss, latency, and jitter and helps ensure deterministic performance of real-time applications.

Proof of Concept Results

Wipro's Flow-based OVS with DPDK QoS software solution is designed to be deployed by CommSPs in enterprise WAN connectivity applications supporting voice, data, video, and all other traffic types. A recent proof of concept (PoC) jointly conducted by Wipro and the Intel® Builders Innovation Fund showed the flexibility of the solution as it was deployed in three different configurations:

- A server based on Intel Atom® processors C2758 for small offices, where fewer applications and services can be expected. In this application, performance demands are not high, but keeping the server cost low is very important.
- A server based on Intel® Xeon® processors D-1548 for medium-sized offices, where more compute power is required to support the expanded throughput and application needs of the office.
- A server based on Intel Xeon processors E5-2603 v3 for a large branch office with a larger user base driving more VNFs, services, and higher data throughput rates.

The PoC results demonstrated how the Wipro flow-based DPDK QoS solution improved performance of real-time traffic in each of these server configurations.[1] In one of the tests, a video stream was sent over a connection without QoS, but when the algorithm was activated the performance of that video stream was visibly improved.

The PoC also noted reductions in network latency and jitter. For the server based on Intel Atom processors, latency dropped from 26,218 microseconds (µs) for a system without QoS to 754 µs with Wipro's QoS feature.[1] For the large office system based on the Intel Xeon processor E5 device, latency was measured at 8,809 µs without QoS and came in at 540 µs with Wipro's QoS feature. Figure 2 shows latency for all of the systems that participated in the PoC.[1]

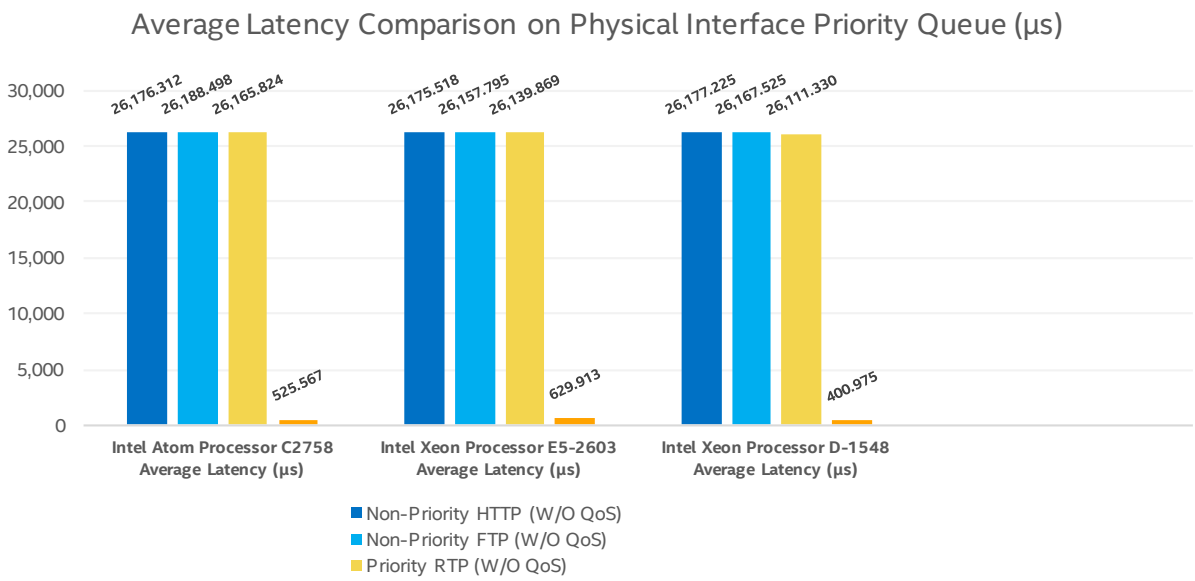

Figure 2. Average latency for QoS and non QoS testing in Intel and Wipro PoC[1]

Conclusion

CommSP IP-based video and voice services are highly dependent on QoS for service quality levels that are acceptable to customers. With many CommSPs moving toward virtualized services networks, Wipro identified the need to support a QoS capability on OVS with DPDK. The company is planning to port the capability to other vSwitches. With the performance of Intel servers, Wipro's Flow-based QoS for OVS with DPDK is able to keep priority traffic flowing in next-generation virtualized networks.

About Wipro

Wipro Limited (NYSE: WIT, BSE: 507685, NSE: WIPRO) is a leading global information technology, consulting and business process services company. It harnesses the power of cognitive computing, hyper-automation, robotics, cloud, analytics, and emerging technologies to help our clients adapt to the digital world and make them successful. A company recognized globally for its comprehensive portfolio of services, strong commitment to sustainability, and good corporate citizenship, we have over 160,000 dedicated employees serving clients across six continents. Together, we discover ideas and connect the dots to build a better and a bold new future.

About Intel® Network Builders

Intel Network Builders is an ecosystem of independent software vendors (ISVs), operating system vendors (OSVs), original equipment manufacturers (OEMs), telecom equipment manufacturers (TEMs), system integrators (SIs), enterprises, and service providers coming together to accelerate the adoption of network functions virtualization (NFV)-based and software-defined networking (SDN)-based solutions in telecom networks and in public, private, and hybrid clouds. The Intel Network Builders program connects service providers and enterprises with the infrastructure, software, and technology vendors that are driving new solutions to the market. Learn more at http://networkbuilders.intel.com.

[1] PoC testing conducted by Wipro in the labs of Prowess Consulting. Configurations: Small office: Supermicro* A1Sai (SKU: 081315D9) system based on the Intel Atom® processor C2758 (2.40 GHz, 8 cores) with 8 GB RAM, an 80-GB Intel® SSD X-25M Series (SC2BB08) drive. NIC: Intel® Ethernet Controller I210. Medium office: Lanner* system based on the Intel® Xeon® processor D-1548 (2.00 GHz, 8 cores) with 8 GB RAM and a 128-GB Transcend* SSD420K drive. NIC: Intel® Ethernet Server Adapter I350. Large office: Supermicro* SuperServer* SYS-5018R-M system based on the Intel Xeon processor E5-2603 v3 (1.60 GHz, 6 cores) with 8 GB RAM and a 128-GB SanDisk* SSD SDSSDP12 drive. NIC: Intel Ethernet Server Adapter I350. Software, all systems: DPDK 16.07, Open vSwitch 2.6, QEMU/KVM hypervisor.

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